Foundation

GCSE

Combined Science B Twenty First Century Science

J260/02: Chemistry (Foundation Tier)

General Certificate of Secondary Education

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 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 a tick to confirm that the work has been seen.

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 **Q6**

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**.

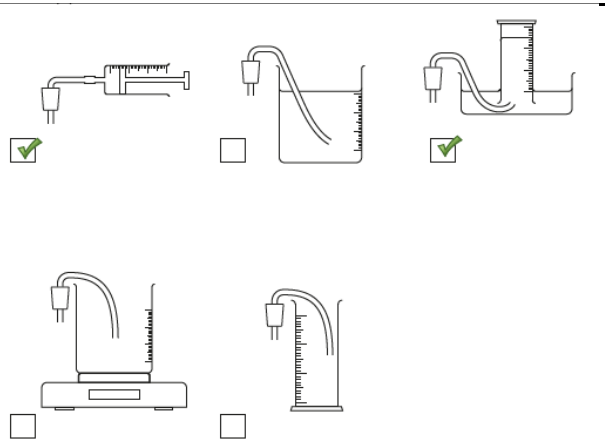
Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

The breakdown of Assessment Objectives for GCSE (9-1) in Combined Science B:

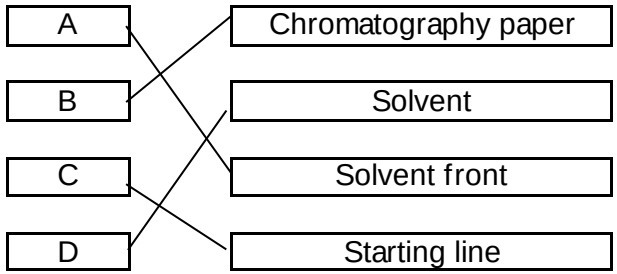
	Assessment Objective
AO1	**Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures.**
AO1.1	Demonstrate knowledge and understanding of scientific ideas.
AO1.2	Demonstrate knowledge and understanding of scientific techniques and procedures.
AO2	**Apply knowledge 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.

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>1</td><td>(a)</td><td>(i)</td><td>
<table>
<tr><th>Element</th><th>Atomic Number</th><th>Group Number</th><th>Period</th><th>Electron configuration</th></tr>
<tr><td>Oxygen ✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>(Sodium)</td><td></td><td>1 ✓</td><td>3 ✓</td><td></td></tr>
<tr><td>(Chlorine)</td><td>17 ✓</td><td></td><td></td><td></td></tr>
<tr><td>(Calcium)</td><td></td><td></td><td></td><td>2.8.8.2 ✓</td></tr>
</table>
</td><td>5</td><td>2.2</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>(Na^+) 2.8 ✓
(Cl^-) 2.8.8 ✓</td><td>2</td><td>2.2</td><td></td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>Ca as 2.8.8 AND oxygen as 2.8 ✓
2+ AND 2- ✓</td><td>2</td><td>2.2</td><td>ALLOW 1 mark for electrons and charge correct for one ion</td></tr>
<tr><td></td><td>(c)</td><td></td><td>
<table>
<tr><th>Compound</th><th>Ions Present</th><th>Formula</th><th>Relative Formula Mass</th></tr>
<tr><td>Sodium Chloride ✓</td><td></td><td></td><td></td></tr>
<tr><td>(Magnesium Chloride)</td><td>Mg^{2+} $(2)Cl^-$ ✓</td><td></td><td>95.3 ✓</td></tr>
<tr><td>Magnesium Oxide ✓</td><td></td><td>MgO ✓</td><td></td></tr>
</table>
</td><td>5</td><td>2.2</td><td>ALLOW use of 24 for relative atomic mass of Mg</td></tr>
</table>

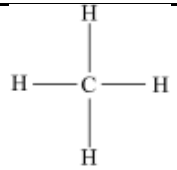
Question			Answer	Marks	AO element	Guidance
2	(a)	(i)	Infrared ✓ The Earth ✓	2	1.1	
		(ii)	Methane ✓	1	1.1	**ALLOW** water vapour, nitrous oxide, CFCs, ozone **IGNORE** carbon monoxide
	(b)		Plant trees/more trees/more crops/more green plants ✓	1	1.1	**ALLOW** use less named fossil fuel/less fossil fuels/ use biofuels/ use electric vehicles/ use renewable energy sources/ use public transport/reduce deforestation/ reforestation etc,
	(c)	(i)	Carried out by other scientists. ✓	1	1.1	
		(ii)	To make sure results can be repeated. ✓	1	1.1	

Question			Answer	Marks	AO element	Guidance
3	(a)	(i)	2(HCl) ✓ $(HCl)_{aq}$ $(ZnCl_2)_{aq}$ $(CO_2)_g$ $(H_2O)_l$ ✓✓✓	4	2.2 1.2 x 3	All 4 state symbols correct = 3 marks 3 or 2 state symbols correct = 2 marks 1 state symbol correct = 1 mark
		(ii)	Hydrochloric (acid) ✓ Zinc chloride ✓	2	2.2	**ALLOW** Hydrogen Chloride
	(b)	(i)	The mass will go down because carbon dioxide gas leaves the flask. ✓	1	2.2	
		(ii)	 ✓✓	2	1.2	

Question			Answer	Marks	AO element	Guidance
4	(a)		So that all the acid is used up. ✓	1	2.2	
	(b)		Heat the solution in the beaker. ✓ Use a more concentrated acid. ✓	2	3.3b	
	(c)		Filter and collect solid residue – FALSE Filter and collect solution – TRUE Evaporate the solution to dryness using a Bunsen Burner – FALSE Leave solution to cool slowly and collect crystals – TRUE ✓✓✓	3	1.2	4 statements correct = 3 marks 3 or 2 statements correct = 2 marks 1 statements correct = 1 mark

Question			Answer	Marks	AO element	Guidance
5	(a)	(i)	T F T ✓✓	2	1.1	3 correct = 2 marks 1 or 2 correct = 1 mark
		(ii)	Movement – faster/more freely/vibrate more ✓ Arrangement – more random/move further apart/not in a fixed position/spread out/spaced out/no longer compact ✓	2	1.1	**ALLOW** idea of moving but still touching **ALLOW** particles sliding past one another
	(b)		Liquid ✓	1	3.2a	
	(c)	(i)	It contains only one element or compound. ✓	1	1.1	
		(ii)	Single temperature if pure/range if impure./ORA ✓	1	1.1	**ALLOW** specific/precise temperature
	(d)	(i)	 ✓✓✓	3	1.2	4 correct = 3 marks 3 or 2 correct = 2 marks 1 correct = 1 mark
		(ii)	Only one spot/dot (moves up the paper) ✓	1	1.2	**ALLOW** a single colour(streak/line/blob)
		(iii)	Use a locating agent at the end. ✓	1	1.2	

Question			Answer	Marks	AO element	Guidance
6*			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)** Explains in detail, including reference to the structure and bonding, why diamond **and** graphite are suitable for the uses stated in the table. *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)** Explains in some detail why diamond **and** graphite are suitable for the uses stated in the table **OR** Explains in detail, including reference to the structure and bonding why diamond **OR** graphite are suitable for the uses stated in the table *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)** Explains with limited detail why diamond **OR** graphite are suitable for the uses stated in the table *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**	**1.1**	**AO1.1 Demonstrates knowledge and understanding of the properties of diamond and graphite in relation to their uses** • Diamond is hard because there are lots of covalent bonds forming a giant covalent structure • Diamond also hard because it has 4 bonds • All 4 electrons are used in bonding in diamond • Diamond has no delocalised electrons to conduct electricity • Diamond hard because strong bonds in all directions. • Graphite much less hard as only has 3 bonds • Graphite uses 3 electrons for covalent bonding, leaving 1 electron free to conduct electricity • Delocalised electrons in graphite to conduct electricity • Layers of graphite only weakly held together so good for use as lubricants • Graphite soft because layers can slide over each other. • Both high melting points because strong bonds between carbon atoms and therefore a lot of energy needed to break bonds

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>7</td><td>(a)</td><td></td><td>Contains hydrogen and carbon <u>only</u>. ✓</td><td>1</td><td>1.1</td><td></td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>Boiling point ✓</td><td>1</td><td>1.1</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Vapourise ✓
Cooler ✓
Molecules ✓
Less ✓</td><td>4</td><td>1.1</td><td></td></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td>C_6H_{14} ✓</td><td>1</td><td>2.2</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>(No) doesn’t match general formula/not enough hydrogens ✓</td><td>1</td><td>2.1</td><td>ALLOW ‘too many Carbons’</td></tr>
<tr><td></td><td>(d)</td><td></td><td>
<table>
<tr><th>Alkane</th><th>Molecular Formula</th><th>Empirical Formula</th><th>Displayed Formula</th><th>3D Structure</th></tr>
<tr><td>Methane ✓</td><td></td><td></td><td>  ✓</td><td></td></tr>
<tr><td>(Ethane)</td><td>C_2H_6 ✓</td><td></td><td></td><td></td></tr>
<tr><td>(Propane)</td><td></td><td>C_3H_8 ✓</td><td></td><td></td></tr>
<tr><td>(Butane)</td><td></td><td>C_2H_5 ✓</td><td></td><td></td></tr>
</table>
</td><td>5</td><td>2.2</td><td></td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
8	(a)		Electrons ✓ Ions ✓ Ions **AND** electrons ✓	3	1.1	**ALLOW** in either order
	(b)	(i)	Loses ✓	1	3.1a	
		(ii)	Magnesium Iron Copper Silver ✓✓	2	3.2b	Mg most reactive **and** silver least reactive = 1 mark Iron more reactive than copper = 1 mark **ALLOW** use of element symbols, but NOT ion symbols
	(c)	(i)	More reactive: Bubbles/effervescence ✓ Faster/more ✓ **OR** Metal disappears ✓ Quicker ✓	2	1.2	Assume 'it' = more reactive metal If named metals from b(ii) **ALLOW ECF** if matched to their order of reactivity **ALLOW** solution warms up more for 2 marks
		(ii)	Not all metals react (with acid) / some metals react too violently (with acids) ✓	1	3.2a	
		(iii)	Pops a lighted splint. ✓	1	1.2	

Question			Answer	Marks	AO element	Guidance
9	(a)	(i)	Carbon (atom) / 1.54 x 10^{-10} **AND** silver (atom) / 2.88 x 10^{-10} ✓	1	2.2	
		(ii)	Carbon (atom) / 1.54 x 10^{-10} Silver (atom) / 2.88 x 10^{-10} Fullerene (molecule) / 1.10 x 10^{-9} Platinum (nanoparticle) / 1.00 x 10^{-8} ✓✓	2	2.2	**ALLOW** 1 mark if carbon is put as smallest **OR** 1 mark for platinum nanoparticle being biggest
	(b)		As size/particle gets bigger, (surface area to volume) ratio gets smaller. ORA ✓ **OR** Size increase ten times, (surface area to volume) ratio decreases ten times/size and ratio are inversely proportional ORA ✓✓	2	3.1a	**ALLOW** size increases 10 times ratio decreases to/by a tenth/words to the effect of going up and down by factor of 10
	(c)		**First check the answer on answer line** **If answer = 600 (nm^2) award 3 marks** Length of one face = 10nm ✓ Substitution: surface area = 6 x (10x10) ✓ = 600 (nm^2) ✓	3	2.2	**ALLOW** mark if 10 is seen in marking **ALLOW ECF** from incorrect length/breadth **DO NOT ALLOW** 6 x 6 x 6 unless qualified/ **DO NOT ALLOW** h and w not the same **ALLOW ECF** from incorrect substitution If candidate has measured the sides of the cube shown by labels on the diagram: MP1 does not score MP2 **ECF** for their values (need not be the same) MP3 **ECF** from substitution

Question			Answer	Marks	AO element	Guidance
10	(a)		**Any two from:** Volume of acid/50cm^3 of acid – measuring cylinder/burette/pipette/graduated beaker ✓ Temperatures measured at start – thermometer ✓ Temperatures measured after each addition/at end– thermometer ✓ Mass/1g of solid/calcium hydroxide portions – balance ✓	2	3.3a	**IGNORE** amount of acid/solid **ALLOW** temperature (change).- using thermometer for 1 mark **ALLOW** scales for balance **IGNORE** weight/weighing **IGNORE** measurement of time **ALLOW** 1 mark for 2 measurements or 2 pieces of apparatus measuring different things.
	(b)		All points correctly plotted ✓✓	2	2.2	Any two points correctly plotted = 1 mark **ALLOW** +/- Half square tolerance
	(c)		Line of best fit ✓	1	2.2	Line must start at 0/22 and end at 5/59.5 and be straight line. **ALLOW ECF** from incorrectly plotted points **IGNORE** line outside grid
	(d)		Y=mx+c ✓	1	3.1a	
	(e)		**First check the answer on answer line** **If answer = 28.5 (^{o}C) award 2 marks** Selection of data from graph: 50.5^{o}C ✓ (Change in temperature: 50.5 – 22.0) = 28.5 ^{o}C ✓	2	3.1a	 **ALLOW** 50-51 ^{o}C **ALLOW** 28-29 ^{o}C
	(f)		**First check the answer on answer line** **If answer = 6104.7 (J) award 3 marks** Mass of hydrochloric acid: 50 x 1.02 = 51(g) ✓ Substitution: change in thermal energy = 4.2 x 28.5 x 51 ✓ = 6104.7(J) ✓	3	2.2	**ALLOW** minimum of 2 significant figures **ALLOW** 3 marks if answer is correct for answer to part e. **ALLOW ECF** from answer to (e)/ incorrectly evaluated mass of acid **ALLOW** correct evaluation from mp2 **IGNORE** incorrect rounding on answer line if correct evaluation given in working.

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