Oxford Cambridge and RSA

Higher

GCSE

Combined Science Chemistry A Gateway Science

J250/09: Paper 9 (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for June 2023

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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 **14.**

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 Combined Science 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	D	1	2.1	
2	B	1	2.2	
3	B	1	1.2	
4	C	1	1.1	**ALLOW** CO_2
5	D	1	2.1	
6	C	1	1.2	
7	D	1	1.1	
8	C	1	2.2	
9	B	1	2.2	
10	D	1	1.1	

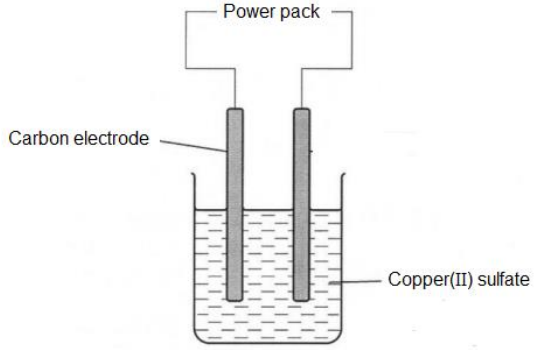
Question			Answer	Marks	AO element	Guidance
11	(a)		Isotopes ✓	1	1.1	
	(b)		Number of protons = 8 Number of neutrons = 9 Number of electrons = 8 ✓✓	2	2 x 2.1	Three correct = 2 marks One or two correct = 1 mark
	(c)		17 ✓	1	2.1	**ALLOW ECF** from 11(b) for incorrectly identified number of protons and neutrons
	(d)		Oxygen ✓	1	2.1	**ALLOW ECF** from an incorrect number of protons in 11(b)
	(e)	(i)	Na = 2.8 ✓ Y = 2.8 ✓	2	2 x 2.2	**ALLOW** any combination of crosses and dots
		(ii)	NaY_2 ☐ Na_2Y ☑ Na_2Y_2 ☐ ✓	1	2.2	
		(iii)	Atoms of **Y** and **Z** have the same number of electrons. ☑ Atoms of **Y** and **Z** have the same number of neutrons. ☐ Atoms of **Y** and **Z** have the same number of protons. ☐ ✓	1	3.1b	

Question			Answer	Marks	AO element	Guidance
		(iv)	**Any 3 from**: Electrostatic forces (between ions) ✓ Attraction between oppositely charged ions / between Na^+ and Y^{2-} ✓ Giant structure / lattice ✓ (Electrostatic forces) are strong / require lots of energy to break ✓	**3**	**3 x 1.1**	Maximum 2 marks if incorrect bonding or particles are mentioned

Question			Answer	Marks	AO element	Guidance
12	(a)		**Stationary phase** = silica gel on a TLC plate ✓ **Mobile phase** = propanone ✓	**2**	**2 x 1.2**	 **ALLOW** solvent for the mobile phase
	(b)		The amount of sample used. ☐ The size of the TLC chamber. ☐ The type of solvent used. ☑ ✓	**1**	**1.2**	
	(c)	(i)	**First check answer on answer line** **If answer = 0.32 award 3 marks** R_f = 15 ÷ 47 ✓ = 0.319 ✓ = 0.32 ✓	**3**	 **2 x 2.2** **1.2**	Maximum 2 marks for any rounding error within the response **ALLOW** equation quoted correctly in words rather than substitution of numbers **ALLOW ECF** from incorrect calculation for decimal places mark
		(ii)	**C** ✓	**1**	**3.2a**	

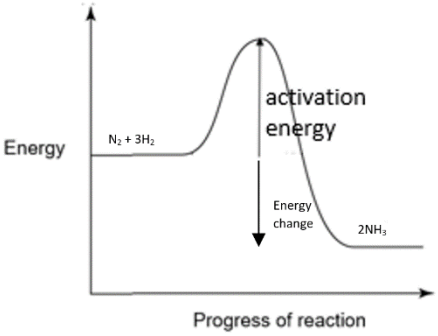
Question			Answer	Marks	AO element	Guidance
13	(a)		**Property** Idea that graphite is soft / diamond is hard ✓ **Explanation** (Graphite) exists as layers ✓ (In graphite) forces between layers are weak / easily broken ✓ **OR** **Property** idea that graphite conducts electricity / heat ✓ **Explanation** <u>delocalised</u> electrons ✓ free to move between the layers / can carry a charge ✓	3	3 x 1.1	**ALLOW ORA** Diamond is hard, with the explanation: All 4 covalent bonds are used. Lots of strong bonds would be within the structure
	(b)		**Property** Idea that both have high melting points ✓ **Explanation** Many covalent bonds / giant covalent structure ✓ (Covalent bonds) are strong / require a lot of energy to break ✓	3	3 x 1.1	Maximum 2 marks if incorrect bonding is mentioned **IGNORE** references to boiling points

Question			Answer	Marks	AO element	Guidance
	(c)		(Models) have (large) gaps between the atoms / size of the atoms are not shown / Bonds shown as solid lines / doesn't show the type of bonding / forces of attraction are not shown / Only shows a limited number of atoms in the molecule / full structure is not shown / Does not show the sharing of electrons / does not show delocalised electrons ✓	1	3.1b	**DO NOT ALLOW** forces of attraction between molecules or ions

Question			Answer	Marks	AO element	Guidance
14*			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)** Draws a suitable working labelled diagram **and** describes the electrolysis process **and** explains how copper can be extracted. *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)** Draws a suitable labelled diagram **and** describes the electrolysis process **or** explains how copper can be extracted **OR** Describes the electrolysis process **and** explains how copper can be extracted *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 draw a labelled diagram **OR** Describes the electrolysis process **OR** Explains how copper can be extracted *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**	**4 x 2.2** **2 x 3.3a**	**AO2.2 Apply knowledge and understanding of scientific enquiry, techniques and procedures** • Cu^{2+} and SO_4^{2-} ions are free to move • ions move to oppositely charged electrodes • copper is deposited at the negatively charged electrode / cathode • Cu^{2+} ions are reduced or gain electrons / $Cu^{2+} + 2e^- \rightarrow Cu$ **AO3.3a Analyse information and ideas to develop experimental procedures,** e.g.: • describes how the apparatus listed would be set up to electrolyse copper sulfate or draws a labelled diagram to show the electrolysis of copper sulfate such as: 

Question			Answer	Marks	AO element	Guidance
15	(a)		Idea that strong acids have a higher degree of ionisation than weak acids / **ORA**	1	1.1	**ALLOW** dissociates as alternative wording to ionisation
	(b)	(i)	H^+ ✓	1	1.1	
		(ii)	(pH meter because) Idea pH meter gives an accurate / specific / numerical reading ✓ Idea that universal indicator relies on interpretation (of colour) ✓	2	2 x 3.3b	Marks are for explanation
	(c)		Idea pH decreases as concentration of hydrochloric acid increases / **ORA** ✓ Idea pH decreases less at higher concentrations of hydrochloric acid ✓	2	2 x 3.1a	
	(d)		Correct values quoted from the graph ✓ Uses correct values and proves pH increases by 1 as concentration of hydrochloric acid increases by a factor of 10 ✓	2	2 x 3.1b	Example values that may be quoted: at pH 2 concentration of hydrochloric acid is 0.01 (mol / dm^3) at pH 1 concentration of hydrochloric acid is 0.1 (mol / dm^3)

Question			Answer	Marks	AO element	Guidance
	(e)		**First check answer on answer line** **If answer = 0.11 g award 4 marks** Concentration of hydrochloric acid at pH 1.5 = 0.03 (mol / dm^3) ✓ **THEN** Mass in 1 dm^3 = 0.03 x 36.5 = 1.095 ✓ Mass in 100 cm^3 = 1.095 ÷ 10 = 0.1095 ✓ = 0.11 (g) (2 significant figures) ✓ **OR** Moles in 100 cm^3 = 0.03 x 0.100 = 0.003 ✓ Mass in 100 cm^3 = 0.003 x 36.5 = 0.1095 ✓ = 0.11 (g) (2 significant figures) ✓	**4** **3.1a** **2 x 2.2** **1.2**	**ALLOW ECF** from incorrect calculation for significant figure mark

Question			Answer	Marks	AO element	Guidance
16	(a)	(i)	Energy to break bonds = (945) + (3 x 435) = 2250 (kJ / mol) ✓	1	2.2	
		(ii)	Energy to make bonds = 6 x 390 = 2340 (kJ/mol) ✓	1	2.2	
		(iii)	Energy change = 2250 – 2340 = -90 (kJ / mol) ✓	1	2.2	**ALLOW ECF** from parts (i) and (ii) **DO NOT ALLOW** 90 /+ 90 unless **ECF** from parts (i) and (iI) give this as a correct answer
	(b)		Products drawn lower than reactants and labelled (2)NH_3 / products ✓ Curve for reaction profile drawn with activation energy labelled ✓ Energy change labelled ✓  	3	3 x 2.2	**DO NOT ALLOW** double headed arrows for either marking point two or marking point three

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