OCR
Oxford Cambridge and RSA

Higher

GCSE

Combined Science B Twenty First Century Science

J260/02: Chemistry (Foundation 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 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.

The level of response question on this paper is **9c**

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.

Question			Answer	Marks	AO element	Guidance
1	(a)		Te **AND** I ✓	1	3.2b	**IGNORE** names if correct
	(b)	(i)	gallium ✓ germanium ✓	2	2.1	**IGNORE** symbols if correct
		(ii)	new elements had properties that matched the gaps ✓	1	1.1	
	(c)		The atomic number is the number of electrons in the atom. ✓ The elements all have the same number of electrons in their outer shell. ✓	2	2.1	
	(d)	(i)	s l aq g ✓✓	2	2.1	4 correct = 2 marks 3 or 2 correct = 1 mark 1 correct = 0 marks
		(ii)	**Any two from:** add pieces of metal to water ✓ time how long to disappear/look at speed of fizzing ✓ disappears faster/fizzing faster down group ✓	2	1.2	

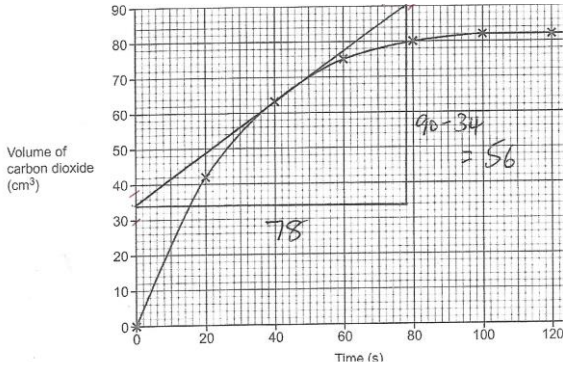
Question			Answer	Marks	AO element	Guidance
2	(a)		giant lattice –> sodium –> attraction between ions and mobile electrons giant lattice –> sodium chloride –> attraction between oppositely charged ions ✓✓✓	3	2.1	4 lines correct = 3 marks 3 or 2 lines correct = 2 marks 1 line correct = 1 mark
	(b)		electrons ✓ mobile mobile fixed ✓ ions ✓	3	2.1	Sodium is a good conductor of electricity when solid because its atoms **/ electrons** / ions are fixed / **mobile**. Sodium chloride conducts when liquid because its atoms / electrons **/ ions** are fixed / **mobile** but does not conduct in solid because they are **fixed** / mobile.
	(c)		(melting point of sodium chloride is) <u>higher</u> (attraction between particles is) <u>higher</u> (so energy needed to separate the particles is) <u>higher</u> ✓✓	2	2.1	All 3 correct = 2 marks 1 or 2 correct = 1 mark
	(d)		K_2O ✓	1	2.2	

Question			Answer	Marks	AO element	Guidance
3	(a)		H^+ OH^- H_2O ✓✓	2	1.1	3 correct = 2 marks 2 or 1 correct = 1 mark
	(b)	(i)	add indicator ✓ (so that you can see a) colour change (on neutralisation) ✓	2	3.3b	**ALLOW** use of pH meter/probe for MP1 and must give pH value = 7 for 2nd mark **ALLOW** idea of colour CHANGE If named indicator given for MP1 then any colour change stated must be correct for that indicator.
		(ii)	add acid drop by drop when nearly neutral –> so that too much acid is not used repeat the experiment until the volumes of acid used are close together -> to check that the results are repeatable use a pipette instead of a measuring cylinder to measure the sodium hydroxide -> exactly the same volume of sodium hydroxide used each time ✓✓	2	1.2	3 correct = 2 marks 2 or 1 correct = 1 mark
	(c)	(i)	high **AND** close together ✓	1	3.2b	
		(ii)	**First check the answer on answer line.** **If answer = 23.4 (cm^3) award 3 marks** 23.4 + 23.5 + 23.4 (= 70.3) ÷ 3 ✓ = 23.43 ✓ = 23.4 (cm^3) correct to 1 dp ✓	3	1.2	**ALLOW** 27.6 + 23.4 + 23.5 + 23.4 (=97.9) ÷ 4 (= 24.47)for 1 mark Standalone mark – any **calculated** value correctly rounded to 1dp

Question			Answer	Marks	AO element	Guidance
4	(a)	(i)	shared ✓	1	1.1	
		(ii)	shared pair of electrons between F atoms ✓ 8 electrons around each fluorine ✓	2	1.2	
	(b)		hot iron wool <u>burns/reacts</u> quickly ✓	1	3.2a	**ALLOW** clear indication that speed of reaction is less than Cl but greater than I eg burns less vigorously/faster than I/ slower than Cl etc.
	(c)		Mix each halogen separately with each halide. ✓ See if there is a colour change. ✓	2	1.2	

Question			Answer	Marks	AO element	Guidance
5	(a)	(i)	⇋ ✓	1	1.1	**ALLOW** two arrows drawn pointing in opposite directions BUT **NOT** a double headed arrow
		(ii)	The ammonia/product reacts back into hydrogen and nitrogen/reactants ✓	1	1.1	**IGNORE** the reaction is reversible (given in stem of the question) **ALLOW** not all nitrogen and hydrogen reacts
		(iii)	When the rate of the forward reaction is <u>the same</u> compared to the rate of the reverse reaction. ✓	1	1.1	
	(b)		It decreases the activation energy. ✓ It increases the rate of reaction. ✓	2	1.1	

Question			Answer	Marks	AO element	Guidance
6	(a)	(i)	**Any one from:** transport ✓ consumer products ✓	1	1.1	**IGNORE** 'as a fuel' Eg fuel for cars/aircraft/buses etc **ALLOW** to make/produce fuels /named fuel
		(ii)	Crude oil is finite / non-renewable / will run out ✓	1	1.1	
	(b)	(i)	4 ✓	1	1.1	
		(ii)	It forms chains and rings with other carbons. ✓	1	1.1	
	(c)	(i)	C_5H_{12} ✓	1	2.2	
		(ii)	C_3H_7 ✓	1	2.2	
	(d)	(i)	covalent for ethene <u>and</u> diamond ✓ small molecule (for ethene)✓ giant molecule (for diamond) ✓	3	1.1	 **ALLOW** simple molecule **ALLOW** giant lattice/network/structure
		(ii)	Poly(ethene) has longer chain (ORA)✓ Poly(ethene) has stronger forces between the particles (ORA) ✓	2	2.1	**ALLOW** appropriate comparison of molecule sizes eg polythene is a bigger molecule than ethene **ALLOW** molecules/chains for particles **DO NOT ALLOW** atoms 'It' = polythene
	(e)		measure temperature ✓ when solid melts/turns to liquid ✓	2	3.3a	**ALLOW** use a thermometer **ALLOW** 'when it melts' **IGNORE** references to boiling point

Question			Answer	Marks	AO element	Guidance
7	(a)		82(cm^3) ✓	1	2.2	
	(b)		100(s) ✓	1	2.2	
	(c)		**First check the answer on the answer line** **If answer = 0.70 +/- 0.05 (cm^3/s) award 4 marks (if evidence of a tangent drawn)** Draws an appropriate tangent to curve at 40s ✓ reads off appropriate time period **AND** volume change using the tangent ✓ rate of reaction = volume change ÷ time period ✓ = 0.70 +/ - 0.05 (cm^3/s) ✓	4	**3.1a** **2.2 x 3**	 Tangent drawn must not go below the curve at any point, and must touch the curve at 40s **ALLOW** correct calculation of rate from an incorrectly drawn tangent for a max of 3 marks If no other marks awarded, **ALLOW** ECF for correctly evaluated expression of MP3 e.g. 63/40 = 1.575cm^3/s for 1 mark

Question			Answer	Marks	AO element	Guidance
8	(a)		1×10^{-10} m ✓	1	1.1	
	(b)		**First check the answer on answer line.** **If answer = 1.4×10^{7} (m) award 3 marks** $2 \div 100 = 0.02$ ✓ $0.02 \times 7 \times 10^{8}$ ✓ $=1.4 \times 10^{7}$ (m) ✓	3	 1.2 2.2 x 2	 **ALLOW** ecf eg $2 \times 7 \times 10^{8}$ = 1.4×10^{9} scores 2 marks

Question			Answer	Marks	AO element	Guidance
9	(a)	(i)	4 ✓ 3 ✓	2	2.2	
		(ii)	positive – O^{2-} – loss – oxygen ✓ negative – Al^{3+} – gain – aluminium ✓	2	2.2	**ALLOW** any 1 correct column = 1 mark
		(iii)	Oxygen reacts with carbon electrode ✓	1	2.2	
	(b)		Aluminium is more reactive than carbon. ✓ Aluminium oxide does not react with carbon. ✓	2	2.1	

	(c)*		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)** Detailed description of how to use apparatus to electrolyse an aqueous solution **AND** Detailed explanation of why oxygen and hydrogen are formed *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)** Basic description of how to use apparatus to electrolyse an aqueous solution **AND** Attempts to explain why oxygen and hydrogen are formed *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)** Basic description of how to use apparatus to electrolyse an aqueous solution **OR** Attempts to explain why oxygen and/or hydrogen are formed *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**	**1.2 x 4** **3.1b x 2**	**AO1.2 Describes use of apparatus** • connects leads to power pack • connects leads to electrodes • pours sodium chloride solution into beaker • dips electrodes into solution • Identifies ions: Na^+ and Cl^- • Notes that bubbles of gas are produced at both electrodes **AO3.1b Explains why hydrogen and oxygen are formed** • Identifies that H^+ and OH^- ions are present in the solution/water • compares H^+ with Na^+ / sodium is more reactive than hydrogen so H^+ gains electrons to form hydrogen • compares OH^- with Cl^- / chloride is more reactive than hydroxide so OH^- loses electrons to form oxygen • Hydrogen and oxygen are preferentially discharged

Question			Answer	Marks	AO element	Guidance
10	(a)	(i)	Carbon monoxide - Incomplete combustion of fossil fuels Particulates - Incomplete combustion of fossil fuels Nitrogen oxides - oxidation of nitrogen at high temperature Sulfur dioxide - combustion of sulfur impurities in fossil fuel ✓✓	2	1.1	Two or three correct = 1 mark Four correct = 2 marks
		(ii)	(Sulfur dioxide forms) acid rain ✓ (Acid rain) damages buildings/damages wildlife/plants corrodes materials ✓	2	1.1	**ALLOW** idea of combining with water to form (sulfuric) acid. **ALLOW** specific effects on humans e.g. breathing difficulties/irritates eyes/irritates skin/destroys buildings etc **IGNORE** air pollution/ harms ecosystems/ unqualified corrosive/ unqualified toxic
		(iii)	**Any one from:** Catalytic converters ✓ Low sulfur petrol ✓ Gas scrubbers ✓	1	1.1	**IGNORE** wrong gases removed by catalytic converter e.g. carbon dioxide **ALLOW** example of using less petrol in cars e.g use of biofuels/hybrid engines/electric cars/walking/cycling/public transport/low emission zones/energy efficient engines etc as alternative marking point

	(b)		(Description of Trends (Fig 10.1 and Fig 10.2) Carbon dioxide concentration and carbon dioxide emissions increase/both graphs increase (with time) ✓ Change in carbon dioxide concentration and carbon dioxide emissions starts at about the same time/ rate of change in carbon dioxide concentration and carbon emissions becomes faster at about the same time ✓	**4**	**3.1a x 2**	**ALLOW** use of specific dates from graph e.g. both start to change in 1870 Increase in carbon dioxide concentration and carbon dioxide emissions starts at about the same time/ rate of increase in carbon dioxide concentration and carbon dioxide emissions becomes faster at about the same time scores **2** marks
			(Explanation with link to Fig 10.3.) Idea that increased carbon dioxide emissions from fossil fuels (fig 1.2)/increased levels of (atmospheric) CO_2 (fig 1.1) has increased global average temperature (fig 1.3) ✓ Idea that increased CO_2 emissions are due to human activities such as start of use of fossil fuels/increase use of cars/ food production/ metal (eg steel) production/ power generation, ✓		**3.2b x 2**	**ALLOW** any acceptable suggestion that could arise due to increase in human activity

Question			Answer	Marks	AO element	Guidance
11	(a)		**(Healthy food)** dyes are tested for safety / natural / won't harm you ✓ **(Scientist)** only 1 substance in pure substance ✓	2	2.1	**DO NOT ALLOW** only one type of atom/element **ALLOW** not pure because it is a mixture of (elements/compounds/substances)/more than one ingredient
	(b)		A **AND** D ✓	1	2.1	
	(c)	(i)	A –> solvent front B –> stationary phase C –> mobile phase ✓✓	2	1.2	3 correct = 2 marks 2 or 1 correct = 1 mark
		(ii)	Their different distribution between phases ✓	1	1.2	
	(d)	(i)	Dye 1 = 2.4(cm) ✓ Solvent = 5.0(cm) ✓	2	1.2	**ALLOW** tolerance of +/- 0.1 for dye only
		(ii)	**First check the answer on answer line.** **If answer = 0.48 award 2 marks** (2.4 ÷ 5.0) ✓ = 0.48 ✓	2	2.2	**ALLOW** 2 marks if answer on answer line is correct for responses in (d)(i).

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