OCR
Oxford Cambridge and RSA

Foundation

GCSE

Chemisty B Twenty First Century Science

J258/02: Depth in Chemistry (Foundation Tier)

General Certificate of Secondary Education

Mark Scheme for June 2024

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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 questions on this paper are **6** and **8.**

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

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.

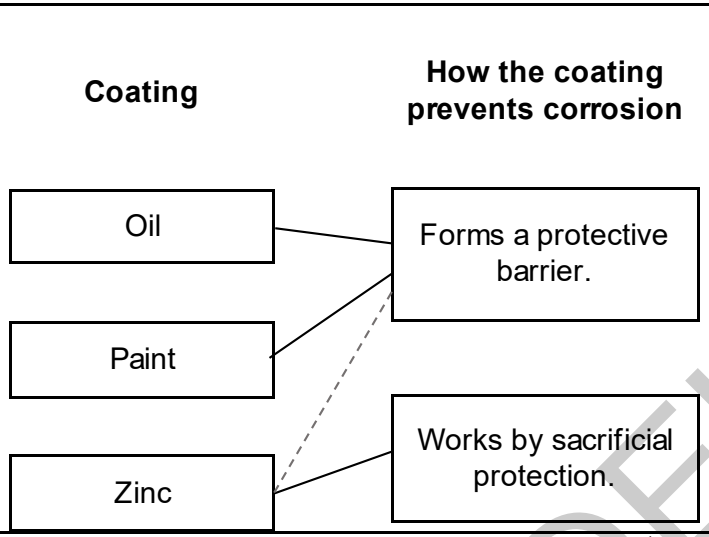
You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New 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 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)		2 electrons shown in first shell / 3 electrons in second shell / total of 5 electrons ✓ 2,3 distribution ✓	2	2.1	
	(b)		positive ✓ protons✓	2	1.1	
	(c)		100 000 cm ✓	1	2.2	
	(d)	(i)	C ✓ Has the highest number of protons and neutrons ✓	2	3.1a	**IGNORE** mention of electrons/shells
		(ii)	Atom **A** has one electron in the outer shell. ✓	1	2.1	

Question			Answer	Marks	AO element	Guidance
2	(a)			2	1.1	**ALLOW** zinc connected to both boxes but zinc must be connected to sacrificial protection to consider zinc correct. All correct = 2 marks Two coatings correct = 1 mark
	(b)		Oxidation is gain of oxygen / loss of electrons ✓ Reduction is loss of oxygen / gain of electrons ✓ Iron is oxidised during corrosion AND iron/iron oxide is reduced during extraction / carbon monoxide is oxidised during extraction AND iron/iron oxide is reduced ✓	3	**2 x 1.1** **2.1**	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>3</td><td>(a)</td><td></td><td>
<table>
<tr><th></th><th>True</th><th>False</th></tr>
<tr><td>Formulations are a mixture of compounds.</td><td>✓</td><td></td></tr>
<tr><td>Formulations contain elements bonded together to make a single compound.</td><td></td><td>✓</td></tr>
<tr><td>The amount of each chemical in a formulation is carefully controlled.</td><td>✓</td><td></td></tr>
</table>
</td><td>2</td><td>1.1</td><td>All correct = 2 marks
Two correct = 1 mark</td></tr>
<tr><td></td><td>(b)</td><td></td><td>Condensation ✓
Evaporation ✓</td><td>2</td><td>1.2</td><td></td></tr>
<tr><td></td><td>(c)</td><td></td><td>tap water contains chlorine/(dissolved) minerals /fluoride/other substances/is a mixture ✓</td><td>1</td><td>1.1</td><td>ALLOW other chemicals/ metal ions</td></tr>
<tr><td></td><td>(d)</td><td></td><td>solvent ✓
stationary ✓
Rf value ✓</td><td>2</td><td>2.2</td><td>All correct = 2 marks
Two correct = 1 mark</td></tr>
<tr><td></td><td>(e)</td><td></td><td>A and C ✓

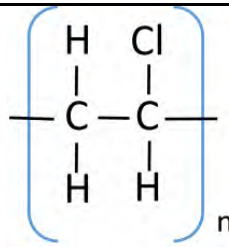
They have a sharp melting point/ single value of melting point AW ✓</td><td>2</td><td>3.1a</td><td>

ALLOW Melting Points do not vary</td></tr>
</table>

	Question		Answer	Marks	AO element	Guidance
4	(a)		2000 (MYA) ✓ because that is when oxygen started to appear ✓ oxygen produced by photosynthesis ✓	3	3.2b 3.1a 1.1	**ALLOW** 1900 – 2000
	(b)		The percentages of gases in the atmosphere have stayed constant for approximately 500 million years.✓ The percentage of nitrogen in the atmosphere today is similar to the percentage of carbon dioxide in the atmosphere 4400 MYA.✓	2	3.1a	
	(c)	(i)	below the boiling point of water / below 100^0C ✓ because the water (cooled and) condensed ✓	2	2.1	**IGNORE** cold
		(ii)	Hydrogen comes from volcanoes and was in the Earth's atmosphere 4400 MYA.✓ The Earth's atmosphere 4400 MYA and volcano gases both contain carbon dioxide.✓	2	3.2a	

Question			Answer	Marks	AO element	Guidance
5	(a)	(i)	Filtration ✓	1	2.2	
		(ii)	A by-product has a use / is used to make a product/ is useful / can be sold ✓ a waste product must be disposed of /goes to landfill ✓	2	1.1	**IGNORE** may be reused/recycled
	(b)		Sulfuric acid ✓	1	2.1	
	(c)	(i)	Keeps going all the time / 24 hours / no need to stop and start / makes more product in a day idea / constant supply✓	1	2.1	
		(ii)	can use equipment for other things / can be done on a small scale / no need for specific equipment ✓	1	2.1	

	Question		Answer	Marks	AO element	Guidance
6	(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)** Makes statements to describe both procedures and both results. *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)** Makes statements to describe a procedure and its results. **OR** Makes statements to describe both procedures. *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)** Makes a statement to describe a procedure or result for at least one test. *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**	**2 x 1.2** **2 x3.1a** **2 x 2.2**	**AO1.2 and 3.1a Demonstrate and develop techniques / procedures** **<u>Describes procedures</u>:** Flame test • heat solid sample • In blue flame • additional detail: use of wire/clean wire in acid • look for colour of flame Sodium hydroxide test • dissolve solid in water / use a solution of the compound • add sodium hydroxide (dropwise) • look for formation of precipitate **AO2.2 Apply techniques / procedures.** **<u>Describes results:</u>** • orange-red flame for calcium / blue-green for copper • white precipitate for calcium / blue ppt for copper
	(b)	(i)	TTF	**2**	**3.2b**	All correct = 2 marks Two correct = 1 mark
		(ii)	Emission spectroscopy is more sensitive than chemical tests.✓	**1**	**1.2**	

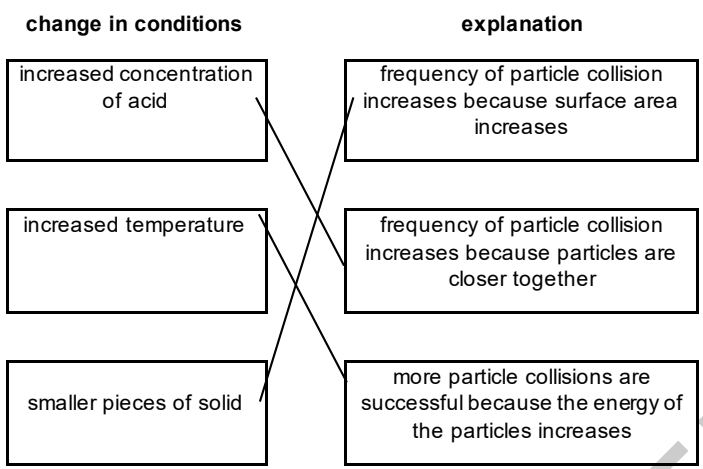
Question			Answer	Marks	AO element	Guidance
7	(a)		6 carbon atoms connected to 12 hydrogen atoms ✓ Single bonds between carbon atoms and continuation bonds at each end ✓	2	2.1	**ALLOW** for 1 mark Hexane structure **DO NOT ALLOW** any H with more than 1 bond
	(b)	(i)	carbon atoms: 24 000 ✓ hydrogen atoms: 48 000 ✓	2	2.1	
		(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 280 000 award 2 marks** Shows in working 2x12 and 4x1 / 28 ✓ Correct answer 280 000 ✓	2	2.1	
	(c)	(i)	C_2H_3Cl ✓	1	2.1	**IGNORE** brackets **ALLOW** different order e.g. Cl C_2H_3
		(ii)	 correct atoms shown C_2H_3Cl✓ no double bond between carbon atoms and brackets, continuation lines and n ✓	2	2.1	**DO NOT ALLOW** answers which are not $(C_2H_3Cl)_n$
	(d)	(i)	ethene is a hydrocarbon with a double bond ✓ chloroethene contains chlorine / is not a hydrocarbon ✓	2	2.1	**ALLOW** If no other marks are awarded, 1 mark for 'ethene contains a double bond'.
		(ii)	both have a (carbon-carbon) double bond ✓	1	2.1	

	Question		Answer	Marks	AO element	Guidance
8*			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)** Gives correct order for all five metals, explains how the data is used and explains why all metals are not tested. *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)** Gives correct order for all five metals and explains how the data is used. **OR** Gives correct order for all five metals and explains why all metals are not tested. *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)** Makes a correct statement about the reactivity of at least two metals. **OR** Explains why all metals are not tested *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**	**2 x 3.2b** **4 x 2.2**	**AO3.2b: Draws conclusions to state an order of reactivity** • (uses information from reaction with water and) states order sodium, calcium, magnesium • (uses information from all reactions to give complete order) sodium calcium magnesium zinc iron. **AO2.2: Explains how data is used.** • the shorter the time, the faster the reaction • states that water reactions give order for sodium, calcium and magnesium but not iron and zinc • iron and zinc do not react with water • reaction with acid gives order for magnesium, zinc and iron **AO2.2 Why all metals are not tested** • idea that there is no need to test sodium and calcium because order already known • sodium and calcium may react too vigorously with acid / safety hazard

Question			Answer	Marks	AO element	Guidance
9	(a)	(i)	all plots plotted correctly ✓✓ best fit line ✓	3	1.2	**ALLOW** ±½ small square (by eye) **ALLOW** 1 mark for 3 points plotted correctly **ALLOW** Best fit based on plotted points (±2 squares) ignoring any identified outliers
		(ii)	values 90 -100✓ Markings on graph showing how reading was made ✓	2	1.2	
	(b)		C_2H_5 ✓	1	2.2	
	(c)		Crude oil is a feedstock for the petrochemical industry.✓ Crude oil is a main source of hydrocarbons. ✓	2	1.1	

Question			Answer	Marks	AO element	Guidance
10	(a)		carbon dioxide causes the greenhouse effect/is a greenhouse gas/climate change/global warming ✓ which makes ice caps or glaciers melt / sea level rise / crops fail / extinctions / extreme weather events ✓ benefits outweigh the risk/cost / idea of long term benefits but short term costs ✓	3	2 x 2.1 3.2a	**IGNORE** references to layers of carbon dioxide /ozone layer / use of fossil fuels **IGNORE** natural disasters/tsunamis **IGNORE** indirect effects e.g. habitat loss/damage to ecosystems **ALLOW** examples of extreme weather e.g. tornadoes/droughts/wildfires
	(b)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 816 (millions of tonnes) award 3 marks** Substitution: 49 = (400÷mass added) x 100 ✓ shows evidence of rearranging formula e.g. (400/49) x 100 ✓ Ans = 816 (millions tonnes) ✓	3	2.2	**ALLOW** 2 or more sig figs from 816.32653…. **ALLOW** 2 marks for (400/49) x 100 seen in answer (MP1 and MP2) **IGNORE** incorrect unit conversion for MP1 and MP2 e.g. **ALLOW** 2 marks for 816 000 000 / 81 600 **DO NOT ALLOW** MP3 if there is a unit conversion Use of 51 rather than 49 loses MP1 only **e.g. ALLOW** 2 marks for 784 million tonnes (answer based on 51%)
	(c)	(i)	> 2.3 x 10^4 millions tonnes ✓	1	3.2b	
		(ii)	demand for transport/cars/vehicles/(domestic) heating/manufacturing / use of renewables / use of other fuels e.g. hydrogen/biogas/fuels from waste. ✓	1	1.1	**IGNORE** demand for fuels/energy alone / cost **ALLOW** demand for fuel for specified use/petrol **IGNORE** population growth / supply of fossil fuels/ efficiency arguments / limits on emissions

Question			Answer	Marks	AO element	Guidance
11	(a)	(i)	Shows upside down measuring cylinder in container with delivery tube entering bottom of cylinder ✓ at least two correct apparatus labels ✓ apparatus and water level appropriate to collect gas (water in container, end of measuring cylinder below level of water, tube in measuring cylinder) ✓	3	2 x 1.2 3.3a	**IGNORE** gas syringe **DO NOT ALLOW** MP1 if tube is shown joined to cylinder **Appropriate labels are:** measuring cylinder, (delivery) tube and trough/beaker/bowl/container/tray… etc **IGNORE** small gaps only
		(ii)	use a gas syringe / use a burette ✓	1	3.3b	
	(b)	(i)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 0.47 (cm^3/s) award 3 marks** Shows (132-48) OR (21 x 4) OR 84 in working ✓ Shows (210-30) OR 180 in working ✓ 84/180 = 0.47 (cm^3/s) ✓	3	2.2	**ALLOW** 2 or more sig figs from 0.466666… seen anywhere in answer **ALLOW MP3 ECF** on incorrect readings but substitution must be correct **For MP3** answer must be given to 2 or more significant figures seen anywhere. **ALLOW** answer on **ECF** to 1dp if calculation computes exactly to 1dp **ALLOW** 0.46 if 84 and 180 are shown in working
		(ii)	The rate of reaction at 120s	1	3.1b	

	(c)			2	1.2	All correct = 2 marks 1 or 2 correct = 1 mark **IGNORE** any box if two lines are shown

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