

# Foundation

**GCSE**

**Chemistry B Twenty First Century Science**

**J258/02: Depth in Chemistry (Foundation Tier)**

General Certificate of Secondary Education

**Mark Scheme for June 2022**

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.

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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.

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**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. Crossed Out Responses**

Where a candidate has crossed out a response and provided a clear alternative then the crossed out response is not marked. Where no alternative response has been provided, examiners may give candidates the benefit of the doubt and mark the crossed out response where legible.

**Rubric Error Responses – Optional Questions**

Where candidates have a choice of question across a whole paper or a whole section and have provided more answers than required, then all responses are marked and the highest mark allowable within the rubric is given. Enter a mark for each question answered into RM assessor, which will select the highest mark from those awarded. *(The underlying assumption is that the candidate has penalised themselves by attempting more questions than necessary in the time allowed.)*

**Multiple Choice Question Responses**

When a multiple choice question has only a single, correct response and a candidate provides two responses (even if one of these responses is correct), then no mark should be awarded (as it is not possible to determine which was the first response selected by the candidate).

*When a question requires candidates to select more than one option/multiple options, then local marking arrangements need to ensure consistency of approach.*

**Contradictory Responses**

When a candidate provides contradictory responses, then no mark should be awarded, even if one of the answers is correct.

**Short Answer Questions** (requiring only a list by way of a response, usually worth only **one mark per response**)

Where candidates are required to provide a set number of short answer responses then only the set number of responses should be marked. The response space should be marked from left to right on each line and then line by line until the required number of responses have been considered. The remaining responses should not then be marked. Examiners will have to apply judgement as to whether a 'second response' on a line is a development of the 'first response', rather than a separate, discrete response. *(The underlying assumption is that the candidate is attempting to hedge their bets and therefore getting undue benefit rather than engaging with the question and giving the most relevant/correct responses.)*

**Short Answer Questions** (requiring a more developed response, worth **two or more marks**)

If the candidates are required to provide a description of, say, three items or factors and four items or factors are provided, then mark on similar basis – that is downwards (as it is unlikely in this situation that a candidate will provide more than one response in each section of the response space.)

**Longer Answer Questions** (requiring a developed response)

Where candidates have provided two (or more) responses to a medium or high tariff question which only required a single (developed) response and not crossed out the first response, then only the first response should be marked. Examiners will need to apply professional judgement as to whether the second (or a subsequent) response is a 'new start' or simply a poorly expressed continuation of the first response.

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. Award No Response (NR) if:
  - there is nothing written in the answer space.

Award Zero '0' if:

- anything is written in the answer space and is not worthy of credit (this includes text and symbols).

Team Leaders must confirm the correct use of the NR button with their markers before live marking commences and should check this when reviewing scripts.

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 **4c** and **6c**

## 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).

<b>Annotation</b>	<b>Meaning</b>
/	alternative and acceptable answers for the same marking point
✓	Separates marking points
<b>DO NOT ALLOW</b>	Answers which are not worthy of credit
<b>IGNORE</b>	Statements which are irrelevant
<b>ALLOW</b>	Answers that can be accepted
( )	Words which are not essential to gain credit
—	Underlined words must be present in answer to score a mark
<b>ECF</b>	Error carried forward
<b>AW</b>	Alternative wording
<b>ORA</b>	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 Biology/Chemistry/Physics/Combined Science B:

	<b>Assessment Objective</b>
<b>AO1</b>	<b>Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures.</b>
AO1.1	Demonstrate knowledge and understanding of scientific ideas.
AO1.2	Demonstrate knowledge and understanding of scientific techniques and procedures.
<b>AO2</b>	<b>Apply knowledge and understanding of scientific ideas and scientific enquiry, techniques and procedures.</b>
AO2.1	Apply knowledge and understanding of scientific ideas.
AO2.2	Apply knowledge and understanding of scientific enquiry, techniques and procedures.
<b>AO3</b>	<b>Analyse information and ideas to interpret and evaluate, make judgements and draw conclusions and develop and improve experimental procedures.</b>
<b>AO3.1</b>	Analyse information and ideas to interpret and evaluate.
AO3.1a	Analyse information and ideas to interpret.
AO3.1b	Analyse information and ideas to evaluate.
<b>AO3.2</b>	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.
<b>AO3.3</b>	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)	(i)		True only for the solid	True only for the liquid	True for both	2	1.1	All correct (2) 3 or 2 correct (1)
			The ions are close together.			✓			
			The ions are attracted by opposite charges.			✓			
			The ions are in a regular arrangement.	✓					
			The ions can move over each other.		✓				
			✓✓						
	(b)	(i)	At 750°C sodium chloride is a <u>solid</u> <b>AND</b> At 750°C magnesium chloride is a <u>liquid</u> ✓				1	2.1	
		(ii)	Ions in different compounds have different charges ✓  The force of attraction between ions is different in different compounds. ✓				2	1.1	
	(c)	(i)	atomic number ✓				1	2.1	
		(ii)	has one electron in its outer shell ✓ loses one electron ✓				2	2.1	<b>IGNORE</b> full shell

Question		Answer			Marks	AO element	Guidance	
2	(a)	Substance	State symbol			2	2.2	
			(s)	(aq)	(l)			
		copper sulfate solution		✓				
		copper hydroxide precipitate	✓					
	(b)	filter ✓ <u>then</u> dry (in an oven) / leave to dry / wash the filtrate (with water) / allow (water) to evaporate ✓			2	3.3a	IGNORE heating to dry	
	(c)	(i)	(as increase in volume of sodium hydroxide is added) mass of copper (hydroxide) goes up ✓ until 25cm <sup>3</sup> / then stays the same ✓			2	3.1a	
		(ii)	(Alex because) Idea that copper sulfate is limiting reagent/can't make more/maximum is 0.98 g ✓ Adding more sodium hydroxide does not have any effect / does not make a difference / graph has levelled out ✓			2	3.2a	Maximum 1 mark If "Jane" is ticked,
	(d)	(i)	Line of best fit ignores outlier and goes from origin <u>and</u> flattens at 0.98 g ✓			1	2.2	ALLOW curve past point at 0.98g
		(ii)	Rings outlier at 10 cm <sup>3</sup> ✓			1	2.2	
		(iii)	Answer between 0.35-0.45 (g) ✓			1	2.2	
		(iv)	The copper hydroxide contained water when Jane weighed it. ✓			1	2.2	

Question		Answer				Marks	AO element	Guidance	
3	(a)	hydrogen → lighted splint → pop ✓ oxygen → glowing splint → relights ✓				2	1.2		
	(b)	potassium hydroxide solution contains charged ions ✓				1	1.2		
	(c)	(i)	Experiment	Mass of hydrogen used (g)	Mass of oxygen used (g)	Mass of water made (g)	2	2.1	
			3	0.50	4.0	4.5 ✓			
			4	1.0	8(.0)	9(.0) ✓			
		(ii)	The hydrogen and oxygen are used up. ✓				1	2.1	
	(d)	(i)	hydrogen releases <u>more energy</u> (per kg of fuel) ✓ hydrogen only produces water / petrol produces harmful emissions OR ✓				2	3.1b	<b>ALLOW (1)</b> if two correct pieces of information are identified from the table without further explanation.
		(ii)	hydrogen is a gas and so is difficult to store/fill up ✓ needs more space to store / need more volume for the same mass of fuel ✓				2	3.1b	<b>IGNORE</b> issues which are not related to the table <b>ALLOW (1)</b> if two correct pieces of information are identified from the table without further explanation.

Question		Answer	Marks	AO element	Guidance
4	(a) (i)	<p><b>Any three from:</b></p> <p>Potassium chloride increases solubility / Sodium chloride increases solubility / both salts increase solubility (as temperature rises) ✓</p> <p>Potassium chloride solubility increases more than sodium chloride with increased temperature / increase temperature does not have a big effect on sodium chloride idea ✓</p> <p>Solubilities are the same at 30°C ✓</p> <p>At low temperatures sodium chloride is more soluble (than potassium chloride) / more sodium chloride (than potassium chloride) dissolves at low temperatures ✓</p> <p>At higher temperatures potassium chloride is more soluble (than sodium chloride) / more potassium chloride dissolves (than sodium chloride) at higher temperatures ✓</p> <p>Quotes 2 or more values from the graph ✓</p>	3	3.1a	
	(b) (i)	<p><b>FIRST CHECK THE ANSWER ON ANSWER LINE</b>  <b>If answer = 50 (g in 100g water) award 2 marks</b></p> <p>substitutes correctly into equation <math>26 + (0.3 \times 80)</math> ✓  calculates value = 50 (g in 100 g water) ✓</p>	2	2.2	
	(ii)	<p>51-53 (g/100g water) ✓</p> <p>(yes or no) Compares answer to Q4 (b) (i)  Idea that answers are very close together / close enough for prediction to be useful / not identical ✓</p>	2	3.1b	

Question	Answer	Marks	AO element	Guidance
	<p>(c)*</p> <p>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</p> <p><b>Level 3 (5–6 marks)</b></p> <p><b>Describes a valid method involving different temperatures, including measurements AND states results.</b></p> <p><i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p><b>Level 2 (3–4 marks)</b></p> <p><b>Describes a method involving different temperatures OR states results</b></p> <p><i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i></p> <p><b>Level 1 (1–2 marks)</b></p> <p><b>States a factor to control OR a measurement to take</b></p> <p><i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i></p> <p>0 marks No response or no response worthy of credit.</p>	6	4 x 2.2 2 x 3.3a	<p><b>Applies knowledge and understanding to describe measurements and results (AO2.2)</b></p> <ul style="list-style-type: none"> <li>• more solid dissolves at higher temperatures</li> <li>• work out difference in mass</li> <li>• measure temperature /states temperatures to use</li> <li>• weigh 100g of water each time</li> </ul> <p><b>Analyses information to develop experimental procedure (AO 3.3a)</b></p> <ul style="list-style-type: none"> <li>• add solid to water until no more solid dissolves and weigh mixture</li> <li>• weigh beaker or bottle of at start</li> <li>• weigh beaker or bottle and solid at end</li> <li>• heat water to different temperatures</li> <li>• use the same amount or mass of water / use 100g of water each time.</li> </ul>


Question		Answer			Marks	AO element	Guidance								
5	(a)	calcium is more reactive than carbon ✓			1	2.1									
	(b)	(i)	Silver ✓			1	1.1								
		(ii)	<p><b>Any two from:</b>  potassium and sodium are in group 1 ✓</p> <p>calcium is not in Group 1 / is in Group 2 / is in another group ✓</p> <p>there are other metals in Group 1/more reactive than carbon which are not shown ✓</p>			2	3.1a								
	(c)	(i)	<table border="1"> <thead> <tr> <th>Metal</th> <th>Extracted by heating with carbon</th> <th>Extracted by electrolysis</th> </tr> </thead> <tbody> <tr> <td>zinc</td> <td>✓</td> <td></td> </tr> <tr> <td>aluminium</td> <td></td> <td>✓</td> </tr> </tbody> </table>	Metal	Extracted by heating with carbon	Extracted by electrolysis	zinc	✓		aluminium		✓	1	2.1	
Metal	Extracted by heating with carbon	Extracted by electrolysis													
zinc	✓														
aluminium		✓													
	(c)	(ii)	carbon and harder ✓			1	1.2								
	(d)	(i)	copper oxide + carbon → copper + carbon dioxide  Fully correct equation [2 marks] ✓✓ One correct product: copper/carbon dioxide [1 mark] ✓			2	2.1	<b>IGNORE</b> any use of state symbols and numbers							
		(ii)	(oxidised) carbon AND (reduced) copper ✓ carbon gains oxygen and copper loses oxygen ✓			2	2.1	<b>ALLOW</b> copper oxide is reduced							
		(iii)	Mass of solids decreases ✓			1	2.1								
		(iv)	Gas is given off / carbon dioxide is given off ✓			1	2.1								



Question		Answer	Marks	AO element	Guidance																				
6	(a)	2 electrons ✓ are shared ✓	2	1.1																					
	(b)	<table border="1"> <thead> <tr> <th></th> <th>Only true for Diamond</th> <th>Only true for carbon dioxide</th> <th>True for both</th> </tr> </thead> <tbody> <tr> <td>It is a compound.</td> <td></td> <td>✓</td> <td></td> </tr> <tr> <td>Each carbon atom has four bonds.</td> <td></td> <td></td> <td>✓</td> </tr> <tr> <td>It is an allotrope of carbon</td> <td>✓</td> <td></td> <td></td> </tr> <tr> <td>It is found in the air.</td> <td></td> <td>✓</td> <td></td> </tr> </tbody> </table> ✓✓		Only true for Diamond	Only true for carbon dioxide	True for both	It is a compound.		✓		Each carbon atom has four bonds.			✓	It is an allotrope of carbon	✓			It is found in the air.		✓		2	1.1	All 4 correct (2) 3 or 2 correct (1)
	Only true for Diamond	Only true for carbon dioxide	True for both																						
It is a compound.		✓																							
Each carbon atom has four bonds.			✓																						
It is an allotrope of carbon	✓																								
It is found in the air.		✓																							

Question	Answer	Marks	AO element	Guidance
(c)*	<p>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</p> <p><b>Level 3 (5–6 marks)</b> Explains differences in terms of energy needed linked to correct discussion of intermolecular forces and bonds.</p> <p><i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p><b>Level 2 (3–4 marks)</b> Explains differences in terms of energy needed linked to strength of forces between particles <u>and</u> makes a correct statement about intermolecular forces or bonds.</p> <p><i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i></p> <p><b>Level 1 (1–2 marks)</b> Explains differences in terms of energy. <b>OR</b> Explains differences in terms of forces.</p> <p><i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i></p> <p><b>0 marks</b> <i>No response or no response worthy of credit.</i></p>	6	2 x 1.1 4 x 2.1	<p><b>Demonstrates knowledge of intermolecular forces and bonds (AO1.1)</b></p> <ul style="list-style-type: none"> <li>• When diamond melts, (covalent) bond break between carbon atoms.</li> <li>• When carbon dioxide melts, intermolecular forces are broken/forces between molecules are broken</li> <li>• (Covalent) bonds (between atoms) are stronger than intermolecular forces</li> <li>• More energy is needed to overcome (covalent) bonds (between atoms) than to break intermolecular forces.</li> <li>• Bond between atoms in carbon dioxide do not break when carbon dioxide melts.</li> </ul> <p><b>Applies knowledge and understanding to explain differences in terms of energy and forces (AO2.1)</b></p> <ul style="list-style-type: none"> <li>• Diamond has higher melting point because it needs more energy to change from a solid to a liquid/to melt ORA</li> <li>• Diamond has higher melting point because more or greater forces need to be broken/overcome to change from a solid to a liquid/to melt ORA</li> <li>• Idea that diamond has a very high melting point / idea that carbon dioxide has a very low melting point / melting point is below room temperature / idea that carbon dioxide is a gas and diamond is a solid</li> </ul>

Question		Answer	Marks	AO element	Guidance
7	(a)	7800 – 8000 ✓	1	2.1	
	(b)	From 320 - 280 ✓	1	2.1	<b>ALLOW</b> 315 – 325 to 285 – 270
	(c)	<b>FIRST CHECK THE ANSWER ON ANSWER LINE</b> <b>If answer = 0.038(%) award 2 marks</b>  Shows 380 / 10000 in calculation /correct substitution ✓  To give 0.038 % ✓	2	2.1	
	(d)	Idea that both follow the same pattern / both increase ✓	1	3.2b	
	(e)	<b>Any two from:</b> ice caps melting ✓ loss of habitats ✓ forest fires ✓ sea level rise / flooding ✓ crops failure ✓ (more) severe weather events ✓	2	1.1	<b>IGNORE</b> Deforestation <b>IGNORE</b> increased temperatures'/global warming <b>IGNORE</b> Tsunamis  <b>IGNORE</b> irregular weather

Question			Answer	Marks	AO element	Guidance
8	(a)	(i)	 ✓	1	1.2	
		(ii)	<p><b>Any two from:</b>            avoid naked flames / don't smoke / no mobile phones / no electronic devices ✓            switch off engine when refuelling ✓            avoid spills/replace cap or petrol nozzle quickly / avoid contact with hands / wear gloves / avoid inhaling vapour ✓</p>	2	1.2	.
	(b)		forms <u>four</u> bonds / has <u>four</u> electrons available for bonding / forms chains/rings/tubes/balls/3 D structures ✓	1	2.1	
	(c)		<p>(structure) polyethene has no bonds between chains / only weak forces between chains / poly(ethene) has weak intermolecular forces / rubber has (sulfur) bonds between chains ✓            (properties) rubber has higher melting point/harder/stronger/not flexible/not stretchy/doesn't break easily ORA ✓</p>	2	2.1	<p><b>ALLOW</b> attractions=forces  <b>ALLOW</b> cross links=bonds  <b>IGNORE</b> <u>rubber</u> has double bonds/intermolecular forces</p>
	(d)	(i)	<p><b>Any one from:</b>            they are in the shape of balls/tubes ✓            they have only one type of atom / only carbon / only one element ✓            they have a large surface area to volume (ratio) / they are very small / measured in nanometres <math>10^{-9}</math> m ✓</p>	1	2.1	<p><b>IGNORE</b> they are 3-D  <b>ALLOW</b> carbon atoms in hexagons/pentagons  <b>IGNORE</b> small/smaller  <b>ALLOW</b> tiny</p>
		(ii)	<p><b>Any two from:</b>            idea that small size allows them to enter cells/tissue/blood ✓            balls and tubes have hollow middles ✓            medicine molecules fit inside ✓</p>	2	1.1	

Question			Answer	Marks	AO element	Guidance
9	(a)	(i)	Reaction is reversible / is an equilibrium reaction / products reform reactants / goes backwards ✓	1	1.1	<b>IGNORE</b> not all reactants form products
		(ii)	nitrogen and hydrogen ✓	1	1.1	<b>IGNORE</b> N <sub>2</sub> and H <sub>2</sub>
	(b)	(i)	<b>FIRST CHECK THE ANSWER ON ANSWER LINE</b> If answer = 13 (%) award 2 marks  19.5 / 150 ✓  (x 100 =) 13 (%) ✓	2	1.2	<b>ALLOW (1)</b> for 0.13 %
		(ii)				
	(c)	(i)	The ammonia <u>dissolves</u> / forms a solution / becomes aqueous ✓	1	2.1	<b>IGNORE</b> reacts
		(ii)	gas syringe ✓	1	3.3b	
	(d)	(i)	accept values >7≤14 ✓	1	1.2	<b>ALLOW</b> above 7 <b>ALLOW</b> stated value or range within >7≤14
		(ii)	use <u>universal</u> indicator/paper / pH indicator/paper ✓  compare colour to (pH) chart/scale ✓	2	1.2	<b>IGNORE</b> indicator alone <b>DO NOT ALLOW</b> other named indicators  <b>IGNORE</b> colour shows pH alone <b>ALLOW</b> M2 if any indicator is given

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