

OCR

Oxford Cambridge and RSA

GCSE Chemistry B (Twenty First Century Science)

J258/03 – Breadth in Chemistry (Foundation Tier)

MARK SCHEME

Duration: 1 hour 45 minutes

MAXIMUM MARK 90

This document consists of 22 pages

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:

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 a 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.

There are no level of response questions on this paper.

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**.

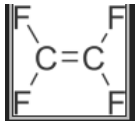
Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

The breakdown of Assessment Objectives for GCSE (9-1) in Chemistry 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) | <p>FIRST CHECK ANSWER ON ANSWER LINE If answer = $0.08 \pm 1 \text{ (cm}^3\text{/s)}$ award 2 marks</p> <p>Change in volume = $8 \pm 1 \text{ (cm}^3\text{)}$ ✓</p> <p>rate = $8 / 100 = 0.08 \text{ (cm}^3\text{/s)}$ ✓</p> | 2 | 2.2 × 2 | <p>ALLOW use of any number 7- 9 anywhere in calculation (1)</p> <p>ALLOW ECF for 2nd mark: rate = change in volume / 100 ALLOW 0.07 – 0.09 (2)</p> |
| | (b) | <p>“Particle size” of carbonate / AW ✓</p> <p>Temperature ✓</p> | 2 | 3.3a × 2 | <p>ALLOW take readings every 200s or less/ same time interval IGNORE ‘the same time’</p> |
| | (c) | <p>Particles closer/have less space / more particles in same volume / more (densely) packed ✓</p> <p>Collide more frequently / higher rate of collisions / more collisions per unit time/per second ✓</p> | 2 | 2.1 × 2 | <p>ALLOW molecules for particles</p> <p>ALLOW more chance of collisions</p> <p>IGNORE more particles / more collisions / faster collisions / energy arguments / more successful collisions /</p> |
| | (d) | <p>FIRST CHECK ANSWER ON ANSWER LINE If answer = $17 \text{ (cm}^3\text{)}$ award 3 marks</p> <p>$0.07 / 0.10$ or $0.10/0.07$ ✓</p> <p>(uses 24)= 16.8 ✓</p> <p>= $17 \text{ (cm}^3\text{)}$ ✓</p> | 3 | <p>2.2 × 2</p> <p>1.2</p> | <p>IGNORE 17.0 ALLOW MP3 for (incorrect) answer with working rounded to 2sf</p> |

| Question | | Answer | Marks | AO element | Guidance | |
|----------|-----|--|-----------|--------------------|---|---------------------------|
| 2 | (a) | No overall loss (in mass) idea / No elements/mass/atoms/chemicals/particles/compounds lost / law states that matter is neither (created nor) destroyed in a chemical reaction / AW ✓ Carbon dioxide is a gas / Carbon dioxide leaves the test tube / a gas is given off / idea that all products are not in the test tube / AW ✓ | 2 | 3.1b x 2 | ALLOW It is an open system | |
| | (b) | FIRST CHECK ANSWER ON ANSWER LINE If answer = 52.2 / 52.4 / 52.3 (%) award 4 marks (formula mass of reactants or MgCO_3) = 84.3/84 ✓ (formula mass of product or CO_2) = 44 ✓ Correct substitution = $44/84.3 \times 100$ / $44/84 \times 100$ ✓ Ans+dec pl= 52.2 / 52.4 / 52.3 (%) (1 decimal place) ✓ | 4 | 2.2 x 3 1.2 | If no marks awarded for MP3 and MP4 ALLOW correct working towards formula masses for max (2) $24(.3) + 12 + (3 \times 16) / 12 + (2 \times 16)$ ALLOW ecf ALLOW 52.1(%) (Rounding assessed in previous question) | |
| | (c) | (i) | 2.2 (g) ✓ | 1 | 2.2 | ALLOW 2 or more sf |
| | | (ii) | 82(%) ✓ | 1 | 2.2 | ALLOW 2 or more sf |
| | (d) | Ions with correct electrons ✓ Charges ✓ | 2 | 1.2 x 2 | ALLOW (1) for one correct ion ALLOW eight electrons in outer shell of Mg ALLOW all oxygen electrons with same symbol IGNORE correct inner shells DO NOT ALLOW incorrect inner shells | |

| Question | | Answer | Marks | AO element | Guidance |
|----------|-----|---|-------|------------|--|
| 3 | (a) | <p>A high breaking strength <u>is good</u> / is strong(er) / won't break / cup would not hold its shape / can hold boiling water / softens <u>above 100</u>/at higher temperature than B or C ✓</p> <p>B low breaking strength <u>is not good</u> / weak(er) / breaks / would not hold its shape / could not hold boiling water /softens <u>below 100</u>/at lower temperature than A or C ✓</p> <p>C low breaking strength <u>is not good</u> / weak(er) / breaks / would hold its shape / could hold boiling water / softens <u>above 100</u>/above B/below A ✓</p> <p>Breaking strength</p> | 3 | 3 × 3.1a | <p>IGNORE list of properties repeated from the table e.g. 'A has high breaking strength, is fairly flexible but softens at 250' = 0</p> <p>Answer must show some processing of information e.g. links properties to 'good' and 'bad' or interprets properties</p> <p>For (3) marks answer must discuss at least two properties</p> |
| | (b) | <p>B ✓ Lowest softening temperature ✓</p> | 2 | 2 × 3.2a | IGNORE references to flexibility/strength |
| | (c) |  | 1 | 2.1 | ALLOW f |

| Question | | | Answer | Marks | AO element | Guidance |
|----------|-----|-------|---|-------|------------|---|
| 4 | (a) | (i) | No/very little/<1% oxygen until 2.5 billion years ago/for about (first) 1.5 billion years AW ✓ Fluctuations but overall increase / up and down but overall rise ✓ | 2 | 2 x 3.1a | ALLOW any number in range 2.8 – 2.5 for 'about 2.5 / 1.2-1.5 for 'about 1.5' IGNORE 'increases and decreases' or 'up and down' alone |
| | | (ii) | 1.7 – 2(.0) | 1 | 3.1a | |
| | | (iii) | Plants/bacteria evolved / photosynthesis ✓ plants/bacteria established / number of plants or bacteria stayed the same / animals evolved / animals use up oxygen / respiration AW ✓ | 2 | 2 x 1.1 | |
| | (b) | | $2\text{FeS}_2 + 7\text{O}_2 \rightarrow \text{Fe}_2(\text{SO}_4)_3 + \text{SO}_2$ | 1 | 1.2 | |

| Question | | Answer | Marks | AO element | Guidance |
|----------|-----|---|-------|------------|---|
| 5 | (a) | Bromine/Br ₂ identified ✓ displaced (by the chlorine) / chlorine is more reactive than bromine ✓ $\text{Cl}_2 + 2\text{Br}^- \rightarrow \text{Br}_2 + 2\text{Cl}^-$ ✓ | 3 | 3 x 1.1 | ALLOW from equation IGNORE 'replace' DO NOT ALLOW 'chloride displaces bromide' ALLOW 'chlorine displaces bromide' for MP2 IGNORE K ⁺ ions |
| | (b) | Astatine reacts with sodium to form NaAt ✓ Astatine is less reactive than iodine ✓ | 1 | 2.1 | |

| Question | | Answer | Marks | AO element | Guidance |
|----------|-----|--|-------|-----------------------------|---|
| 6 | (a) | large surface area to volume ratio / (very) small but have a large surface area ✓ | 1 | 1.1 | |
| | (b) | <p>For: (More complete combustion hence) less pollutants / less harmful gases / less incomplete combustion / less named pollutant: (carbon) particulates / carbon monoxide / CO, unburnt fuel/hydrocarbons AW ✓</p> <p>Carbon monoxide is toxic//blocks haemoglobin / CO or particulates or unburnt HCs cause breathing or respiratory difficulties / particulates cause asthma/breathing difficulties / may cause cancer etc ✓</p> <p>Against: CeO₂/nanoparticles (may be) harmful / toxic / risks not known ✓</p> | 3 | 3.1b 1.1 3.1b | <p>IGNORE 'more complete combustion' alone (repeats Q) IGNORE 'less pollution'</p> <p>ALLOW idea of nanoparticles may harm humans, plants, animals or the environment IGNORE 'nanoparticles may be pollutants /cause pollution' (too vague)</p> |
| | (c) | Charges balance/neutral/cancel / oxygen gives an overall charge of 4- / there are two O ²⁻ ions AW ✓ | 1 | 1.2 | IGNORE charges are equal |
| | (d) | <p>FIRST CHECK ANSWER ON ANSWER LINE If answer = 3×10^{-21} (mol) award 3 marks</p> <p>Molecules in one nanoparticle = $8 \times 10^{-27} / 4 \times 10^{-30} / = 2000$ ✓</p> <p>Recall Avogadro constant = $6(.0) \times 10^{23}$ ✓</p> <p>Moles = $2 \times 10^3 / 6 \times 10^{23} = 3.3 \times 10^{-21}$ (mol) ✓</p> | 3 | 2.2 1.2 2.2 | <p>ALLOW full credit (3) marks for any answer which starts by cubing volumes</p> <p>ALLOW correct working shown OR 2000 for (1)</p> <p>ALLOW ECF</p> |

| Question | | | Answer | Marks | AO element | Guidance |
|----------|-----|------|--|-------|------------|--|
| 7 | (a) | (i) | Equilibrium sign / \rightleftharpoons / arrows point both ways ✓ | 1 | 1.1 | ALLOW answers referring to the sign/arrow IGNORE it is reversible |
| | | (ii) | forward and back(ward) reactions / both directions / reactants(N ₂ and O ₂) forming products (NO) <u>and</u> products forming reactants ✓ rates are equal ✓ | 2 | 2 × 1.1 | ALLOW equations for the correct reactions |
| | (b) | (i) | Fertilisers / explosives | 1 | 1.1 | ALLOW for growth of/nitrates for plants but IGNORE plants alone/ammonia/Haber process |
| | | (ii) | No change ✓ Equal moles/molecules/particles on each side (of the equation) ✓ | 2 | 2 × 1.1 | Mark separately |
| | (c) | | Any two FOR: 100% atom economy / all reactants used up idea ✓ No by-products / no waste ✓ raw materials come from the air ✓ sustainable ✓ works at low pressure / AW ✓ Any one AGAINST: (very) high temperature (needed) / needs a lot of energy/fuel / doesn't give 100% yield / low yield ✓ | 3 | 3 × 2.1 | ALLOW 'high atom economy' IGNORE 'readily available' IGNORE 'renewable' |

| Question | | | Answer | Marks | AO element | Guidance |
|----------|-----|------|--|-------|------------|--|
| 8 | (a) | (i) | $\text{MnO}_2(\text{s}) + 2\text{C}(\text{s}) \rightarrow 2\text{CO}(\text{g}) + \text{Mn}(\text{s})$ correct formulae and balancing ✓ state symbols ✓ | 2 | 2 × 1.2 | ALLOW state symbol mark for any version of manganese oxide + carbon → carbon oxide + manganese |
| | | (ii) | Manganese is less reactive than carbon ORA ✓ carbon reduces / removes oxygen from / donates electrons to manganese (oxide) ✓ | 2 | 2 × 2.1 | |
| | (b) | | strong forces/bonds/attraction / electrostatic attractions between ✓ (free/delocalised/sea of) electrons ✓ and positive ions (from metal) ✓ | 3 | 3 × 1.1 | DO NOT ALLOW intermolecular forces IGNORE metal atoms DO NOT ALLOW protons/nuclei |

| Question | | Answer | Marks | AO element | Guidance |
|----------|-----|--|-------|------------|---|
| 9 | (a) | (contains) potassium / K ✓ | 1 | 1.2 | |
| | (b) | (i) lines ✓ (lines are) coloured / (lines are) on a dark/black background ✓ | 2 | 2 × 1.1 | ALLOW 'series/range of colours' IGNORE 'on a white background' |
| | | (ii) Compare/match the spectrum with the known spectrum (of potassium/(ECF answer to (a)) / AW ✓ | 1 | 1.2 | |
| | (c) | (i) White precipitate | 1 | 1.2 | IGNORE cream |
| | | (ii) $\text{BaCl}_2 + \text{Na}_2\text{SO}_4 \rightarrow \text{BaSO}_4 + 2\text{NaCl}$ correct formula for one product $\text{BaSO}_4/\text{NaCl}$ ✓ fully correct equation with balancing ✓ | 2 | 2 × 1.2 | |

| Question | | Answer | Marks | AO element | Guidance |
|----------|-----|--|-------|----------------|--|
| 10 | (a) | Hydrogen is produced at the cathode Water contains H ⁺ and OH ⁻ ions | 1 | 1.1 | Both needed |
| | (b) | <p>FIRST CHECK ANSWER ON ANSWER LINE If answer = (+)490 (kJ/mol) award 3 marks</p> <p>(bonds broken): (= 4(O–H)) OR 1856 (kJ/mol) ✓</p> <p>(bonds made): (= 2(H–H) + O=O) OR 1366 (kJ/mol) ✓</p> <p>energy change (= 1856 – 1366) / (bonds broken – bonds made) = (+) 490 (kJ/mol) ✓</p> | 3 | 3 × 2.2 | <p>For MP1 and MP2 ALLOW either correct working or correct value</p> <p>DO NOT ALLOW -490 (if sign is shown, must be correct)</p> <p>ALLOW ECF for maximum (2) If answer should be negative (by ecf), then negative sign must be shown for third mark to be scored. Plus sign is not necessary.</p> |
| | (c) | | 3 | 2 × 2.2 1.1 | <p>Water on LHS lower than hydrogen and oxygen higher on RHS ✓</p> <p>ALLOW ECF for exothermic diagram from a negative answer to (b)</p> <p>DO NOT PENALISE correct diagram if answer to (b) is incorrect</p> <p>Curve with hump ✓</p> <p>Activation energy labelled with arrow starting at reactants and ending at peak of hump ✓</p> <p>ALLOW double arrow / line with end stops</p> <p>DO NOT ALLOW downwards arrow</p> |

| Question | | Answer | Marks | AO element | Guidance |
|----------|-----|---|-------|------------|--|
| 11 | (a) | $Al^{3+} + 3e \rightarrow Al \checkmark$ $2O^{2-} \rightarrow O_2 + 4e \checkmark$ | 2 | 2 x 1.2 | <p>ALLOW equations with electrons on the right (eg $Al^{3+} \rightarrow Al - 3e$)</p> <p>ALLOW $O^{2-} \rightarrow \frac{1}{2}O_2 + 2e$</p> <p>ALLOW (1) mark if number of electrons are correct for both equations but on incorrect sides of both equations (even if oxygen is shown as O)</p> |
| | (b) | <p>ions / charged particles \checkmark</p> <p>can't move in solid / held in lattice / do not move / in fixed positions \checkmark</p> <p>can move in liquid/when molten \checkmark</p> | 3 | 3 x 1.1 | DO NOT ALLOW electrons/'particles' alone |

| Question | Answer | Marks | AO element | Guidance |
|----------|--|-------|------------|---|
| (c) | <p>FIRST CHECK ANSWER ON ANSWER LINE If answer = 667etc (dm³) award 4 marks</p> <p>4 × 27(g) (=108) ✓ =1000 ÷ 108 ECF (= 9.259) ✓ 3 × 24 (dm³) (=72) ✓ = (x 72 ECF =) 667 (dm³) ✓</p> <p>OR No moles Al = 1000/27 (=37.04) ✓ Uses ratio 4:3 in calculation ✓ No moles O₂ = ANS × ¾ (=27.77.....) ✓ (x 24=) 667 (dm³) ✓</p> | 4 | 4 × 2.2 | <p>9.259 = (2) for MP1 and MP2 0.667 = (3) for MP1 MP3 and MP4 222 = (3) for MP1 MP2 and MP4 0.222 = (2) for MP1 and MP4</p> <p>ALLOW 666 (Rounding already assessed in earlier Q) ALLOW any number of sig figs</p> <p>27.7 = (3) for MP1, MP2 and MP3</p> |

| Question | | Answer | Marks | AO element | Guidance |
|----------|-----|--|-------|----------------|---|
| 12 | (a) | (The arrow shows that) the acid is fully dissociated/ionised / the reaction goes to completion AW / there is no equilibrium sign ✓ | 1 | 1.1 | |
| | (b) | (i) | 1 | 1.2 | |
| | | (ii) | 3 | 1.2 2 × 2.2 | ALLOW ECF |
| | | (iii) | 3 | 3 × 2.2 | ALLOW ECF (including from part (ii)) 0.102 = (1) for MP2 ALLOW answer with working to 2 sig figures |