

F**GCSE (9–1)****Combined Science A (Gateway Science)****J250/04: Paper 4 (Foundation Tier)**

General Certificate of Secondary Education

Mark Scheme for Autumn 2021

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.

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.

© OCR 2021

1. 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 |

2. 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 |

3. 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 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. |

J250/04

Mark Scheme

October 2021

| Question | | | Answer | Marks | AO element | Guidance |
|----------|--|--|--------|-------|------------|----------|
| 1 | | | D ✓ | 1 | 1.1 | |
| 2 | | | B ✓ | 1 | 1.1 | |
| 3 | | | A ✓ | 1 | 1.2 | |
| 4 | | | B ✓ | 1 | 1.1 | |
| 5 | | | B ✓ | 1 | 1.1 | |
| 6 | | | D ✓ | 1 | 1.1 | |
| 7 | | | B ✓ | 1 | 1.2 | |
| 8 | | | D ✓ | 1 | 2.2 | |
| 9 | | | C ✓ | 1 | 2.2 | |
| 10 | | | B ✓ | 1 | 2.2 | |

J250/04

Mark Scheme

October 2021

| Question | | | Answer | Marks | AO element | Guidance |
|----------|-----|--|----------------|-------|------------|----------|
| 11 | (a) | | 7✓ | 1 | 2.1 | |
| | (b) | | Less reactive✓ | 1 | 2.1 | |
| | (c) | | Solid ✓ | 1 | 2.1 | |
| | (d) | | Higher ✓ | 1 | 2.1 | |

J250/04

Mark Scheme

October 2021

| Question | | Answer | Marks | AO element | Guidance |
|----------|-----|--|-------|--------------|--|
| 12 | (a) | Potassium ✓ | 1 | 1.1 | |
| | (b) | (i) | 1 | 1.1 | DO NOT ALLOW just O ALLOW water <u>vapour</u> |
| | | (ii) | 1 | 1.1 | ALLOW sodium hydroxide <u>only</u> if water vapour given above |
| | | (iii) | 2 | 2.1 1.1 | ORA ALLOW slower ORA |
| | (c) | Sodium ✓ Has a higher density than potassium ✓ OR Potassium ✓ Has a lower density than sodium ✓ | 2 | 3.2a 3.2b | Explanation must match the chosen metal for the mark ALLOW density increases down the group but density of potassium falls |

J250/04

Mark Scheme

October 2021

| Question | | Answer | Marks | AO element | Guidance |
|----------|-----|---|-------|------------|--|
| 13 | (a) | <u>Fractional</u> distillation ✓ | 1 | 1.2 | DO NOT ALLOW just distillation |
| | (b) | <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 2px 5px;">Y</div> <div style="border: 1px solid black; padding: 2px 5px;">W</div> <div style="border: 1px solid black; padding: 2px 5px;">Z</div> <div style="border: 1px solid black; padding: 2px 5px;">X</div> </div> ✓ | 1 | 1.2 | |
| | (c) | (i) Alkanes ✓ | 1 | 1.1 | |
| | | (ii) C_nH_{2n+2} ✓ | 1 | 1.1 | |
| | | (iii) Any value between -25 and 0°C ✓ | 1 | 3.1a | |
| | (d) | (i) Carbon monoxide ✓ | 1 | 1.1 | ALLOW CO |
| | | (ii) It's toxic/poisonous ✓ | 1 | 1.1 | ALLOW answer in terms of prevents oxygen transport in blood DO NOT ALLOW just hazardous to health |

J250/04

Mark Scheme

October 2021

| Question | | Answer | Marks | AO element | Guidance |
|----------|---------|---|-------|------------|--|
| 14 | (a) | $(74.2 - 73.4 =) 0.8 \text{ (g)}$ ✓ | 1 | 1.2 | |
| | (b) | Ideas based on heat the reaction for longer/until no more steam produced/ until <u>more</u> of the solid turns white/no further colour change ✓ | 1 | 3.3b | ALLOW ideas based on heating to constant mass |
| | (c) (i) | CuSO_4 ✓ 5 ✓ | 2 | 2 x 2.2 | |
| | (ii) | (White solid) turns blue ✓ Reaction is reversible ✓ | 2 | 2 x 3.1a | ALLOW (whiter solid) returns to original colour |
| | (iii) | Exothermic ✓ | 1 | 2.1 | |

| Question | | Answer | Marks | AO element | Guidance |
|----------|-----|---|-------|------------|--|
| 15 | (a) | $2\text{Al}_2\text{O}_3$ ✓ 4Al and 3O_2 ✓ | 2 | 2 x 2.2 | ALLOW any correct multiples if applied correctly to all three chemicals |
| | (b) | (i) | 2 | 2 x 1.1 | |
| | | (ii) | 1 | 1.1 | |
| | (c) | Any two from: less energy needed to melt aluminium (than aluminium oxide) ✓ electricity (for electrolysis) expensive ✓ no need to buy cryolite ✓ electrolysis cell not needed ✓ less mining of aluminium oxide needed ✓ | 2 | 2 x 2.1 | |

| Question | Answer | Marks | AO element | Guidance |
|----------|--|-------|---------------------|---|
| 16* | <p>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</p> <p>Level 3 (5–6 marks) Detailed description of the trends in the graphs AND how they are linked. AND Detailed explanation of the trends in the graphs.</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>Level 2 (3–4 marks) Detailed description of the trends in the graphs AND how they are linked. OR Describes the trends in the graphs. AND Explains the trends in the graphs.</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>Level 1 (1–2 marks) description of the trends in the graphs AND how they are linked. OR Describes the trends in the graphs. OR Explains the trends in the graphs.</p> | 6 | 3 x 2.1 3 x 3.1a | <p>Description of trends AO3.1a Analyse information and ideas to interpret data in Fig. 16.1 and Fig. 16.2</p> <ul style="list-style-type: none"> • carbon dioxide concentration increases as consumption of oil/coal/gas increases • carbon dioxide concentration increases steadily but fossil fuel consumption dips in the late 2000s • carbon dioxide concentration increases steadily but coal/oil/gas consumption do not <p>Explanation of trends AO2.1 Apply knowledge and understanding of the link between fossil fuel use and levels of atmospheric CO₂</p> <ul style="list-style-type: none"> • fossil fuels contain carbon/are hydrocarbons/ alkanes • burning of oil/coal/gas/fossil fuels releases carbon dioxide into the atmosphere • fossil fuels are not the only source of carbon dioxide |

J250/04

Mark Scheme

October 2021

| Question | Answer | Marks | AO element | Guidance |
|----------|--|-------|------------|----------|
| | <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 <i>No response or no response worthy of credit.</i></p> | | | |

J250/04

Mark Scheme

October 2021

| Question | | Answer | Marks | AO element | Guidance |
|----------|---------|--|-------|-------------------------------|--|
| 17 | (a) | <p>FIRST CHECK ANSWER ON ANSWER LINE If answer = between 16.5 and 16.9 award 3 marks</p> <p>use of correct figures from graph for calculating gradient e.g. $50 \div 3$. ✓</p> <p>correct answer e.g. 16.66•/16.67 ✓</p> <p>answer to 1 decimal place e.g. 16.7 ✓</p> | 3 | <p>2 x 2.2</p> <p>1 x 1.2</p> | |
| | (b) | <p>Rate decreases ✓</p> <p>(as reaction progresses) There are fewer reactant (magnesium/acid) particles ✓</p> <p>The <u>frequency</u> of collisions decreases ✓</p> | 3 | 3 x 2.1 | IGNORE less collisions |
| | (c) (i) | (gradient increases) as the rate of reaction increases/faster reaction ✓ | 1 | 3.2b | IGNORE gradient increase / increase alone ALLOW answers based on ideas of increased number or increased frequency of collisions |
| | (ii) | 40 (cm ³) ✓ | 1 | 3.2b | |

J250/04

Mark Scheme

October 2021

| Question | | Answer | Marks | AO element | Guidance |
|----------|--|---|-------|------------------------------|----------|
| 18 | | S is the catalyst ✓ speeds up the reaction AND remains unchanged ✓ R and T are not catalysts ✓ R reacts/ T does not speed up reaction ✓ | 4 | 2.1 1.1 2.1 1.1 | |

OCR (Oxford Cambridge and RSA Examinations)
The Triangle Building
Shaftesbury Road
Cambridge
CB2 8EA

OCR Customer Contact Centre

Education and Learning

Telephone: 01223 553998

Facsimile: 01223 552627

Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored