

GCSE (9-1)

Chemistry A (Gateway)

Unit **J248F/01**: Foundation Tier – Paper 1

General Certificate of Secondary Education

Mark Scheme for June 2018

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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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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 |

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 |

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 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. |

For answers to Section A if an answer box is blank ALLOW correct indication of answer e.g. circled or underlined.

| Question | | | Answer | Marks | AO element | Guidance |
|----------|--|--|--------|-------|------------|----------|
| 1 | | | A ✓ | 1 | 1.2 | ALLOW 1 |
| 2 | | | A ✓ | 1 | 1.1 | |
| 3 | | | D ✓ | 1 | 1.1 | |
| 4 | | | D ✓ | 1 | 1.1 | |
| 5 | | | C ✓ | 1 | 1.1 | |
| 6 | | | B ✓ | 1 | 2.1 | |
| 7 | | | A ✓ | 1 | 2.1 | |
| 8 | | | D ✓ | 1 | 2.1 | |
| 9 | | | C ✓ | 1 | 1.1 | |
| 10 | | | C ✓ | 1 | 2.1 | ALLOW 4 |
| 11 | | | B ✓ | 1 | 2.1 | ALLOW 2 |
| 12 | | | A ✓ | 1 | 1.2 | |
| 13 | | | C ✓ | 1 | 1.1 | |
| 14 | | | B ✓ | 1 | 1.1 | |
| 15 | | | C ✓ | 1 | 1.1 | |

| Question | | Answer | | | | Marks | AO element | Guidance | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|------|--|----------------------------|--------------------------|--------------------------|------------------|----------------------------|--------------------------|--------------------------|------------------|---|----|----|-------|------------|---|----|----|-----|---------------|---|----|----|--------|--------------|---|----|----|---|--|---|---------|--|
| 16 | (a) | <table border="1"> <thead> <tr> <th>Reaction</th> <th>Temperature at start in °C</th> <th>Temperature at end in °C</th> <th>Temperature change in °C</th> <th>Type of reaction</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>20</td> <td>25</td> <td>(+) 5</td> <td>exothermic</td> </tr> <tr> <td>B</td> <td>18</td> <td>10</td> <td>- 8</td> <td>endothermic ✓</td> </tr> <tr> <td>C</td> <td>21</td> <td>35</td> <td>(+) 14</td> <td>exothermic ✓</td> </tr> <tr> <td>D</td> <td>20</td> <td>20</td> <td>0</td> <td></td> </tr> </tbody> </table> | | | | Reaction | Temperature at start in °C | Temperature at end in °C | Temperature change in °C | Type of reaction | A | 20 | 25 | (+) 5 | exothermic | B | 18 | 10 | - 8 | endothermic ✓ | C | 21 | 35 | (+) 14 | exothermic ✓ | D | 20 | 20 | 0 | | 3 | 3 x 2.2 | |
| | | Reaction | Temperature at start in °C | Temperature at end in °C | Temperature change in °C | Type of reaction | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | A | 20 | 25 | (+) 5 | exothermic | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | B | 18 | 10 | - 8 | endothermic ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | C | 21 | 35 | (+) 14 | exothermic ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| D | 20 | 20 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Temperature change in BOTH reactions A and D ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| (b) | C ✓ | | | | 1 | 2.2 | ecf on ΔT | | | | | | | | | | | | | | | | | | | | | | | | | | |
| (c) | (i) | 100 (kJ) ✓ | | | | 1 | 2.2 | ALLOW -100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| | (ii) | 50 (kJ) ✓ | | | | 1 | 2.2 | | | | | | | | | | | | | | | | | | | | | | | | | | |

| Question | | Answer | | Marks | AO element | Guidance | |
|----------|-----|--|----------------|-------|------------|--|------------------------|
| 17 | (a) | | | 2 | 2 x 2.1 | | |
| | | | Element | | | | Number of atoms |
| | | | C | | | | 4 |
| | | | H | | | | 6 |
| | | O | 4 | | | | |
| | | All correct ✓✓ One or two correct ✓ | | | | | |
| | (b) | C ₂ H ₃ O ₂ ✓ | | 1 | 2.1 | Order of atomic symbols unimportant e.g. ALLOW H ₃ C ₂ O ₂ | |
| | (c) | Solid ✓ Idea that melting point is above 25°C ✓ | | 2 | 2 x 2.1 | ALLOW not reached 184 °C/melting point ; IGNORE boiling point Independent marking points | |

| Question | | Answer | Marks | AO element | Guidance |
|----------|---------|---|-------|--------------------------|--|
| 18 | (a) | Salt is soluble or dissolves in water (so filtration will not work) ✓ Distillation ✓ | 2 | 2 x 3.3b | ALLOW forms (salt) solution IGNORE fractional ALLOW evaporate and condense |
| | (b) | Fractional distillation ✓ as liquids have different boiling points ✓ | 2 | 2 x 3.2b | ALLOW higher level answers in terms of intermolecular forces |
| | (c) (i) | Consists of just one element or substance ✓ | 1 | 1.2 | |
| | (ii) | No (no mark) pure samples do not have a range of mpt ✓ Sample 4 has range higher than 120°C ✓ Any one from: Pure samples cannot have melting point above 120°C ✓ Sample 2 is likely to be most pure ✓ | 3 | 2 x 3.2a 1 x 3.2b | ALLOW pure samples have single mpt/impure samples have a range of mpts/ impure samples have more than one mpt/4 has a range of mpt ALLOW sample 4 has higher melting point so cannot be pure/pure sample cannot have a higher mpt./impure sample has lower mpt than 120 °C IGNORE boiling point |

| Question | | Answer | Marks | AO element | Guidance |
|----------|---------|---|-------|-------------------------|--|
| 19 | (a) | Solid ✓ | 1 | 1.2 | |
| | (b) | 1.76 ✓ | 1 | 2.2 | |
| | (c) | No (no mark) 20g calcium carbonate will make 11.2g of calcium oxide ✓ and 8.8g of carbon dioxide ✓ | 2 | 2 x 3.1b | ALLOW idea that he has the numbers reversed for both marks ALLOW idea that mass of CO ₂ is always lower than CaO for one mark ora |
| | (d) (i) | 40.3 (g) ✓ | 1 | 2.2 | ALLOW 40 |
| | (ii) | Correct idea of $48.6 + 32 = 80.6$ ✓ (demonstrates law of conservation of mass) since both sides are equal ✓ | 2 | 1 x 2.2 1 x 3.2a | ALLOW $48 + 32 = 80$ (must use data) MAX 1 for full argument using 64.6/64 |

| Question | | Answer | | | | Marks | AO element | Guidance | | | | | | | | | | | | |
|--------------------|------------------|--|------------------|--|--|-------------|------------|--------------------|------------------|--------------------|-----|-----------|------------|-------------|------------------|--------|--------|---|---------|--|
| 20 | (a) | Points plotted correctly ✓ Straight line through all points except point at 6 minutes ✓ | | | | 2 | 2 x 2.2 | ALLOW ± ½ square | | | | | | | | | | | | |
| | (b) | Point on graph at 6 minutes circled ✓ | | | | 1 | 2.2 | | | | | | | | | | | | | |
| | (c) | OH ⁻ and SO ₄ ²⁻ ✓ | | | | 1 | 2.2 | BOTH REQUIRED | | | | | | | | | | | | |
| | (d) | <table border="1"> <thead> <tr> <th>Molten salt</th> <th>Formula</th> <th>Product at cathode</th> <th>Product at anode</th> </tr> </thead> <tbody> <tr> <td>potassium chloride</td> <td>KCl</td> <td>potassium</td> <td>chlorine ✓</td> </tr> <tr> <td>lead iodide</td> <td>PbI₂</td> <td>lead ✓</td> <td>iodine</td> </tr> </tbody> </table> | | | | Molten salt | Formula | Product at cathode | Product at anode | potassium chloride | KCl | potassium | chlorine ✓ | lead iodide | PbI ₂ | lead ✓ | iodine | 2 | 2 x 2.2 | DO NOT ALLOW chloride/Cl/Cl ⁻ ALLOW Cl ₂ ALLOW Pb DO NOT ALLOW Pb ²⁺ |
| Molten salt | Formula | Product at cathode | Product at anode | | | | | | | | | | | | | | | | | |
| potassium chloride | KCl | potassium | chlorine ✓ | | | | | | | | | | | | | | | | | |
| lead iodide | PbI ₂ | lead ✓ | iodine | | | | | | | | | | | | | | | | | |

| Question | | Answer | Marks | AO element | Guidance |
|----------|-----|---|-------|------------|---|
| 21 | (a) | <p>DIAMOND Any two from: Transparent ✓ Does not conduct electricity ✓ High melting point ✓ High boiling point ✓</p> <p>GRAPHITE Any two from: Good electrical conductor ✓ Soft ✓ High melting point ✓ High boiling point ✓ (Dark) grey ✓</p> | 4 | 4 x 1.1 | <p>ALLOW higher level answers to explain the property e.g has delocalised electrons to explain conduction has no delocalised electrons to explain non-conduction strong (covalent) bonds throughout structure to explain high mpt/bpt layers with weak force between to explain soft/brittle</p> <p>ALLOW brittle</p> <p>ALLOW black</p> |
| | (b) | Covalent ✓ | 1 | 1.1 | |
| | (c) | <p>Any two from: Graphite has a layered structure ✓ Weak forces between layers ✓ (which) allow layers to slide (over each other) ✓</p> | 2 | 2 x 1.1 | <p>ALLOW in sheets/in layers ALLOW weak bonds between layers</p> <p>IGNORE intermolecular forces</p> |

| Question | | Answer | Marks | AO element | Guidance |
|----------|-----|---|-------|------------|--|
| 22 | (a) | Electrons ✓ | 1 | 1.1 | |
| | (b) | Protons AND neutrons ✓ | 1 | 1.1 | BOTH REQUIRED |
| | (c) | Idea that the relative mass of protons and neutrons is 1 ✓ and that of electrons is 0.0005 or very small (in comparison) ✓ | 2 | 2 x 1.1 | ALLOW protons and neutrons have (significant) mass/more mass than electrons DO NOT ALLOW grams ALLOW mass of electron is negligible Max 1 if g used |
| | (d) | Any two from: Isotopes ✓ same number of protons/ same atomic number ✓ different numbers of neutrons/ different mass numbers ✓ | 2 | 2 x 1.1 | DO NOT ALLOW different number of electrons ALLOW atomic mass DO NOT ALLOW relative atomic mass |

| Question | | Answer | Marks | AO element | Guidance |
|----------|-----|--|-------|------------|--|
| 23 | (a) | Water ✓ | 1 | 1.2 | |
| | (b) | Idea that different inks move across the paper at different speeds ✓ | 1 | 1.2 | ALLOW inks have different solubilities (in water) / different adsorption (to paper) ALLOW different R _f values |
| | (c) | (i) FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 0.50 award 2 marks 2.6 and 5.2 ✓ 2.6/5.2 = 0.5(0) ✓ | 2 | 2.2 2.2 | Ecf IGNORE units |
| | | (ii) A ✓ Has same pattern as ink from cheque ✓ | 2 | 2 x 2.2 | ALLOW green same R _f values |

| Question | Answer | Marks | AO element | Guidance |
|----------|--|-------|---------------------------------|---|
| 24 * | <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) Analyses the information to identify the type of bonding present in all three substances AND provides a correct explanation for two of them AND a basic explanation for the third <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) Analyses the information to identify the type of bonding present in two of the substances AND provides a correct explanation for one of them / a basic explanation for both of them OR Analyses the information to identify the type of bonding present in two of the substances AND provides a basic explanation for two of them OR Analyses the information to identify the type of bonding present in three of the substances AND provides a basic explanation for one of them</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> | 6 | 2 x 2.1 2 x 3.1a 2 x 3.2b | <p>AO3.2b Analyses information to draw conclusions about the three substances</p> <ul style="list-style-type: none"> • substance A is covalently bonded • substance A is simple molecular • substance B is a metal / has metallic bonding • substance C is an ionic compound <p>AO3.1a Analyses information to interpret the type of bonding present in all three substances</p> <ul style="list-style-type: none"> • substance A has a low melting point and boiling point so is covalent • substance A does not conduct electricity so is likely to be covalent • substance B has high melting point and boiling point and is a good conductor so is a metal or has metallic bonding • substance C has a high melting point and boiling point but does not conduct as a solid so is likely to be an ionic compound • substance C does not conduct as a solid but does when molten so is likely to be an ionic compound <p>AO2.1 Applies knowledge and understanding to identify information about the three substances</p> <ul style="list-style-type: none"> • substance A has a low melting point and boiling point • substance A does not conduct electricity • substance B has high melting point and boiling point and is a good conductor • substance C has a high melting point and boiling point but does not conduct as a solid |

| Question | Answer | Marks | AO element | Guidance |
|----------|--|-------|------------|--|
| | <p>Level 1 (1–2 marks) Analyses the information to identify the type of bonding present in one of the substances AND provides a basic explanation</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 <i>No response or no response worthy of credit.</i></p> | | | <ul style="list-style-type: none"> substance C does not conduct as a solid but does when molten |

| Question | | | Answer | Marks | AO element | Guidance |
|----------|-----|------|--|-------|------------|---|
| 25 | (a) | (i) | Particles close together / particles compact / particles already touching / particles tightly packed / AW ✓ | 1 | 1.1 | <p>ALLOW idea of particles with no spaces between them</p> <p>ALLOW any type of particles</p> <p>Mark can be awarded from a diagram</p> <p>IGNORE particles are in fixed positions</p> <p>IGNORE particles are in a regular arrangement / particles are in a lattice</p> <p>IGNORE intermolecular forces</p> |
| | (a) | (ii) | <p>Any three from:</p> <p>Particles in a solid are in fixed positions ✓</p> <p>Particles in a solid vibrate ✓</p> <p>Particles in a liquid can move (past each other) ✓</p> <p>as forces between particles in a liquid are less than in a solid ✓</p> | 3 | 3 x 1.1 | <p>ALLOW any type of particles</p> <p>ALLOW particles in a solid cannot move (past each other)</p> <p>IGNORE solid cannot flow, but ALLOW particles in a solid cannot flow</p> <p>IGNORE particles move around on the spot</p> <p>IGNORE liquid can flow, but ALLOW particles in a liquid can flow</p> <p>ALLOW liquid particles have enough energy to overcome attractions (between particles)</p> <p>DO NOT ALLOW no forces between particles</p> <p>IGNORE intermolecular forces</p> |

| Question | | Answer | Marks | AO element | Guidance |
|----------|-------|---|-------|------------|--|
| (a) | (iii) | <p>Any two from:</p> <p>Particles are moving quickly (in all directions) ✓</p> <p>Particles are far apart ✓</p> <p>Particles spread out ✓</p> <p>Weak forces between the particles ✓</p> | 2 | 2 x 1.1 | <p>ALLOW any type of particles</p> <p>ALLOW particles can move freely or randomly</p> <p>ALLOW M2 from a diagram showing no particles touching</p> <p>IGNORE intermolecular forces</p> <p>IGNORE no forces between particles</p> |
| (b) | | <p>$\text{Mg} + 2\text{H}_2\text{O} \rightarrow \text{Mg}(\text{OH})_2 + \text{H}_2$</p> <p>Correct formulae ✓</p> <p>Balancing ✓</p> | 2 | 1.1 2.2 | <p>Balancing mark is conditional on correct formulae</p> <p>ALLOW = or = instead of →</p> <p>DO NOT ALLOW and or & instead of +</p> <p>ALLOW any correct multiples including fractions e.g. $2\text{Mg} + 4\text{H}_2\text{O} \rightarrow 2\text{Mg}(\text{OH})_2 + 2\text{H}_2$</p> <p>ALLOW one mark for correct equation with minor errors in case, subscript or superscript e.g. $\text{MG} + 2\text{H}^2\text{O} \rightarrow 2\text{Mg}(\text{OH})_2 + \text{H}_2$</p> <p>IGNORE state symbols</p> |
| (c) | | 148.3 ✓ | 1 | 2.2 | ALLOW 148 |

| Question | | Answer | Marks | AO element | Guidance | | | | | | | | | | | | |
|----------------------|---|--|-----------|-------------------------|--|---------------|--------------|-------------------------|----------------------|----------------|--------------|-------------------|---|--------------------|---|---------|-------------------------------|
| 26 | (a) | <p>Any four from: Titration ✓</p> <p>Put acid in burette ✓ Pipette (a known volume of) sodium hydroxide into flask ✓</p> <p>Use a (named) indicator / use of a pH meter ✓ Add acid to sodium hydroxide until colour of indicator changes ✓ Repeat (to get an accurate value) ✓ Repeat again with no indicator ✓ Evaporate (off the water) / crystallise ✓</p> | 4 | 4 x 3.3a | <p>ALLOW other methods involving adding acid to sodium hydroxide solution using the principles outlined on the LHS eg ALLOW mix or react acid with alkali</p> <p>ALLOW alkali in burette ALLOW acid in flask</p> <p>DO NOT ALLOW marks in incorrect context</p> | | | | | | | | | | | | |
| | (b) | $\text{NaOH} + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O}$ ✓ | 1 | 2.2 | <p>ALLOW = or ⇌ instead of → DO NOT ALLOW and or & instead of +</p> <p>ALLOW any correct multiples including fractions</p> <p>IGNORE any state symbols</p> | | | | | | | | | | | | |
| | (c) | <table border="1"> <thead> <tr> <th>Acid used</th> <th>Other starting material</th> <th>Salt made</th> </tr> </thead> <tbody> <tr> <td>sulfuric acid</td> <td>copper oxide</td> <td>copper sulfate ✓</td> </tr> <tr> <td>nitric acid ✓</td> <td>zinc carbonate</td> <td>zinc nitrate</td> </tr> <tr> <td>hydrochloric acid</td> <td>magnesium oxide/ magnesium hydroxide / magnesium carbonate / magnesium ✓</td> <td>magnesium chloride</td> </tr> </tbody> </table> | Acid used | Other starting material | Salt made | sulfuric acid | copper oxide | copper sulfate ✓ | nitric acid ✓ | zinc carbonate | zinc nitrate | hydrochloric acid | magnesium oxide/ magnesium hydroxide / magnesium carbonate / magnesium ✓ | magnesium chloride | 3 | 3 x 2.2 | ALLOW correct formulae |
| Acid used | Other starting material | Salt made | | | | | | | | | | | | | | | |
| sulfuric acid | copper oxide | copper sulfate ✓ | | | | | | | | | | | | | | | |
| nitric acid ✓ | zinc carbonate | zinc nitrate | | | | | | | | | | | | | | | |
| hydrochloric acid | magnesium oxide/ magnesium hydroxide / magnesium carbonate / magnesium ✓ | magnesium chloride | | | | | | | | | | | | | | | |
| | (d) | Neutralisation ✓ | 1 | 2.2 | | | | | | | | | | | | | |

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