

**GCSE (9–1)**

**Combined Science B (Twenty First Century Science)**

**J260/06: Chemistry (Higher Tier)**

General Certificate of Secondary Education

**Mark Scheme for November 2020**

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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

| 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).

| <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                                           |

**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 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)  | Gas particles leave the flask ✓                                                                                                                                                                                                                                          | 1     | 1.2                  |                                                                                                                                                                                        |
|          |     | (ii) | <b>FIRST CHECK THE ANSWER ON ANSWER LINE</b><br><b>If answer = 0.012 award 3 marks</b><br><br>$0.7 \div (1 \times 60)$ ✓<br>$= 0.01166666\dots$ ✓<br><br>$= 0.012 \text{ (g/s) (2sf)}$ ✓                                                                                 | 3     | 2.2x2<br><br><br>1.2 | <b>ALLOW</b> any number of significant figures e.g. 0.01<br><b>ALLOW</b> ecf from incorrect calculation                                                                                |
|          | (b) |      | Use more concentrated acid ✓<br>Use powdered calcium carbonate instead of pieces ✓                                                                                                                                                                                       | 2     | 3.3b                 |                                                                                                                                                                                        |
|          | (c) | (i)  | gas syringe ✓<br>graduated ✓<br><b>OR</b><br>collection over water with measuring cylinder ✓<br>graduations ✓                                                                                                                                                            | 2     | 1.2                  | <b>ALLOW</b> labels to identify apparatus and graduations.                                                                                                                             |
|          |     | (ii) | (Yes because)<br>Any <b>one</b> from:<br>Rate/volume of gas increases when temperature increases ✓<br>Volume of gas given off equivalent to rate ✓<br>Volume of gas doubles every 10°C ✓<br><b>AND</b><br>Uses data to justify proportionality/rate doubles every 10°C ✓ | 2     | 3.2b                 | <b>DO NOT ALLOW</b> if 'no' is selected.<br><br><b>NOTE</b> (yes because) rate of gas doubles every 10°C = 2 marks<br><b>NOTE</b> (no because) rate of gas doubles every 10°C = 1 mark |

| Question |     |      | Answer                                                                                                                                                                              |         |                    | Marks | AO element | Guidance                                                                                     |
|----------|-----|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|--------------------|-------|------------|----------------------------------------------------------------------------------------------|
| 2        | (a) |      | Symbol                                                                                                                                                                              | Na atom | F <sup>-</sup> ion | 3     | 2.1        | One mark for two correct<br>Two marks for three/four correct<br>Three marks for five correct |
|          |     |      | Atomic number                                                                                                                                                                       | 11      | (9)                |       |            |                                                                                              |
|          |     |      | Number of protons                                                                                                                                                                   | (11)    | (9)                |       |            |                                                                                              |
|          |     |      | Number of electrons                                                                                                                                                                 | 11      | 10                 |       |            |                                                                                              |
|          |     |      | Number of neutrons                                                                                                                                                                  | 12      | 10                 |       |            |                                                                                              |
|          |     |      | ✓✓✓                                                                                                                                                                                 |         |                    |       |            |                                                                                              |
|          | (b) | (i)  | (Same period) because both have 3 shells ✓<br>(Different group) because different number of electrons in outer shell ✓                                                              |         |                    | 2     | 2.1        | <b>ALLOW</b> have same number of shells                                                      |
|          |     | (ii) | (Argon is) unreactive (because it has a full outer shell of electrons) ✓                                                                                                            |         |                    | 1     | 1.1        | <b>IGNORE</b> stable/not very reactive                                                       |
|          | (c) | (i)  | <u>positive</u> (metal) ions / cations<br>(delocalised) electrons<br>✓                                                                                                              |         |                    | 1     | 1.1        | <b>BOTH</b> needed for one mark                                                              |
|          |     | (ii) | Malleable – ions slide past each other<br>Solid conducts electricity – outer shell electrons move freely<br>High melting point – strong attraction between ions and electrons<br>✓✓ |         |                    | 2     | 1.1        | three correct = 2 marks<br>two correct = 1 mark                                              |

| Question |     |      | Answer                                                                                                                                                                                                                                                                                                                                                                           | Marks | AO element | Guidance                                                                                                                               |
|----------|-----|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------|----------------------------------------------------------------------------------------------------------------------------------------|
| 3        | (a) | (i)  | <b>bromine (liquid to gas)</b><br>particles go from moving around each other to moving in all directions ✓<br>particles move further apart (but are still randomly arranged) ✓<br><br><b>water (solid to liquid)</b><br>particles move from regular arrangement to more randomly arranged ✓<br>particles vibrate about a fixed position and then start to move past each other ✓ | 4     | 1.1        | Must be comparisons.<br><br><br><br><br><br><br><br><br><br><b>ALLOW</b> idea of increased movement<br><b>DO NOT ALLOW</b> move freely |
|          |     | (ii) | Any <b>two</b> from:<br><br>Particles are not spheres ✓<br>Particles are diatomic in Bromine gas / not single atoms ✓<br>Gaps between gas particles much bigger than shown ✓                                                                                                                                                                                                     | 2     | 1.1        |                                                                                                                                        |
|          | (b) | (i)  | Any <b>one</b> from:<br>The solid melts over a range of temperatures ✓<br>The solid melts at a different temperature than the value in data book. ✓<br><br><b>AND</b> (explanation)<br>Mixtures contain two or more chemical substances which aren't chemically bonded together, (and can be separated by physical methods) ✓                                                    | 2     | 2.2        |                                                                                                                                        |
|          |     | (ii) | Use paper chromatography ✓                                                                                                                                                                                                                                                                                                                                                       | 1     | 2.2        |                                                                                                                                        |

| Question |     |      | Answer                                                                                                                                                  |                                       |                 | Marks | AO element | Guidance                                                                                                                              |
|----------|-----|------|---------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|-----------------|-------|------------|---------------------------------------------------------------------------------------------------------------------------------------|
| 4        | (a) | (i)  | Particle                                                                                                                                                | Relative Mass                         | Relative Charge | 2     | 1.1        | One mark for all relative masses correct<br>One mark for all relative charges correct<br><b>ALLOW</b> +1 for mass of protons/neutrons |
|          |     |      | Proton                                                                                                                                                  | 1                                     | +1/+            |       |            |                                                                                                                                       |
|          |     |      | Neutron                                                                                                                                                 | 1                                     | 0/neutral       |       |            |                                                                                                                                       |
|          |     |      | Electron                                                                                                                                                | Almost 0/<br>negligible/0.0005/1/1840 | -1/-            |       |            |                                                                                                                                       |
|          |     |      | ✓✓                                                                                                                                                      |                                       |                 |       |            |                                                                                                                                       |
|          |     | (ii) | protons <b>AND</b> neutrons are in nucleus ✓<br>electrons are orbiting/in shells (around the nucleus) ✓                                                 |                                       |                 | 2     | 1.1        | <b>ALLOW</b> more developed models if they are scientifically correct<br><b>ALLOW</b> surrounding the nucleus                         |
|          | (b) |      | <b>FIRST CHECK THE ANSWER ON ANSWER LINE</b><br><b>If answer = 4300 (m) award 2 marks</b><br><br>43 x 1 x 10 <sup>5</sup> (mm) ✓<br>÷ 1000 = 4300 (m) ✓ |                                       |                 | 2     | 2.1<br>1.2 |                                                                                                                                       |

| Question |     |      | Answer                                                                                                                       | Marks | AO element | Guidance |
|----------|-----|------|------------------------------------------------------------------------------------------------------------------------------|-------|------------|----------|
| 5        | (a) | (i)  | 4 ✓                                                                                                                          | 1     | 1.1        |          |
|          |     | (ii) | Any <b>two</b> from:<br>forms (lots of) bonds with other carbons ✓<br>forms rings ✓<br>forms chains (of different lengths) ✓ | 2     | 1.1        |          |
|          | (b) | (i)  | C <sub>6</sub> H <sub>14</sub> ✓                                                                                             | 1     | 2.1        |          |
|          | (b) |      | Similar chemical properties ✓<br><br>Trend in physical properties/ correct example of trend in physical properties ✓         | 2     | 1.1        |          |

| Question | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Marks | AO element                                           | Guidance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6*       | <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><br/> <b>Fully describes nature of the chemical bonds in the compounds</b><br/> <b>AND</b><br/> <b>compares the melting points of the compounds</b><br/> <b>AND</b><br/> <b>explains why the melting points are different.</b><br/> <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><br/> <b>Describes nature of the chemical bonds in the compounds</b><br/> <b>AND</b><br/> <b>compares the melting points of the compounds.</b><br/> <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><br/> <b>Describes nature of the chemical bonds in the compounds</b><br/> <b>OR</b><br/> <b>compares the melting points of the compounds.</b><br/> <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><br/> <i>No response or no response worthy of credit.</i></p> | 6     | <b>1.1 x 2</b><br><b>3.1a x 2</b><br><b>3.2a x 2</b> | <p><b>AO1.1 Description of nature of bonding</b></p> <ul style="list-style-type: none"> <li>• ionic electron transfer</li> <li>• ionic has charged particles</li> <li>• ionic giant lattice</li> <li>• (strong) attraction between ions/attraction in all directions</li> <li>• covalent has shared electrons</li> <li>• covalent bonds strong</li> <li>• intermolecular bonds weak</li> <li>• simple covalent has small molecules</li> <li>• polymers have large molecules</li> </ul> <p><b>AO3.1a Compares the melting points</b></p> <ul style="list-style-type: none"> <li>• <math>\text{PCl}_3</math> low(est) melting point</li> <li>• <math>\text{NaCl}</math> high(est) melting point</li> <li>• PVC melts over a range</li> </ul> <p><b>AO3.2a Explains difference in melting points</b></p> <ul style="list-style-type: none"> <li>• intermolecular bonds weak in <math>\text{PCl}_3</math></li> <li>• little energy needed to separate <math>\text{PCl}_3</math> molecules</li> <li>• PVC higher than <math>\text{PCl}_3</math> because molecules are longer</li> <li>• PVC has range because molecules with different lengths</li> <li>• <math>\text{NaCl}</math> high because strong attraction between ions</li> <li>• <math>\text{NaCl}</math> high because all ions are attracted to ions around</li> </ul> |

| Question |     |      | Answer                                                                                                                                                                                                                                                                                                                           | Marks | AO element               | Guidance                                          |
|----------|-----|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------------------------|---------------------------------------------------|
| 7        | (a) |      | Any <b>one</b> from:<br>both increase over time <u>and</u><br>similar pattern idea / both increasing more and more ✓<br>as carbon emissions increase the amount of carbon dioxide in the atmosphere increases ✓                                                                                                                  | 1     | 3.1a                     |                                                   |
|          | (b) |      | Any <b>two</b> from:<br>plant trees ✓<br>carbon capture ✓<br>examples of energy saving ✓                                                                                                                                                                                                                                         | 2     | 1.1                      | <b>DO NOT ALLOW</b> alternative sources of energy |
|          | (c) | (i)  | Any <b>three</b> from:<br>electric cars do not use fossil fuels/produce CO <sub>2</sub> ✓<br>mains electricity for recharging electric cars could be made from fossil fuels ✓<br>mains electricity for recharging electric cars could be made without using fossil fuels ✓<br>CO <sub>2</sub> reduced if less fossil fuel used ✓ | 3     | 2.1                      |                                                   |
|          |     | (ii) | <b>FIRST CHECK THE ANSWER ON ANSWER LINE</b><br><b>If answer = 1170 (kg) award 4 marks</b><br><br>(mass produced by old car = ) $1200 \times 2.1 = 2520$ ✓<br>$90 \div 1000 = 0.09$ ✓<br>(mass produced by new car = ) $15000 \times 0.09 = 1350$ ✓<br>(difference = $2520 - 1350$ ) ✓                                           | 4     | 2.2<br>1.2<br>2.2<br>1.2 |                                                   |

| Question                                                                                                     |                       |                       | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Marks                  | AO element            | Guidance              |                                                                                             |                     |                |                                                                                     |   |  |                                                                                                              |                |  |   |     |                                                 |                  |    |  |  |                        |   |     |                                                                           |
|--------------------------------------------------------------------------------------------------------------|-----------------------|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|-----------------------|-----------------------|---------------------------------------------------------------------------------------------|---------------------|----------------|-------------------------------------------------------------------------------------|---|--|--------------------------------------------------------------------------------------------------------------|----------------|--|---|-----|-------------------------------------------------|------------------|----|--|--|------------------------|---|-----|---------------------------------------------------------------------------|
| 8                                                                                                            | (a)                   | (i)                   | The mole – the amount of substance containing the same number of particles as there are atoms in 12g of carbon-12. ✓<br>Avogadro constant – number of atoms in 12g of carbon-12. ✓                                                                                                                                                                                                                                                                                       | 2                      | 1.1                   |                       |                                                                                             |                     |                |                                                                                     |   |  |                                                                                                              |                |  |   |     |                                                 |                  |    |  |  |                        |   |     |                                                                           |
|                                                                                                              |                       | (ii)                  | ✓✓✓ <table><tr><th>Substance</th><th>Relative formula mass</th><th>Mass of substance (g)</th><th>Number of moles of substance</th><th>Number of molecules</th></tr><tr><td>O<sub>2</sub></td><td></td><td></td><td></td><td></td></tr><tr><td>H<sub>2</sub></td><td></td><td>4</td><td></td><td>1.2 x 10<sup>24</sup></td></tr><tr><td>H<sub>2</sub>O</td><td>18</td><td></td><td></td><td>3.0 x 10<sup>23</sup></td></tr></table>                                       | Substance              | Relative formula mass | Mass of substance (g) | Number of moles of substance                                                                | Number of molecules | O <sub>2</sub> |                                                                                     |   |  |                                                                                                              | H <sub>2</sub> |  | 4 |     | 1.2 x 10 <sup>24</sup>                          | H <sub>2</sub> O | 18 |  |  | 3.0 x 10 <sup>23</sup> | 3 | 2.2 | four correct = 3 marks<br>three correct = 2 marks<br>two correct = 1 mark |
| Substance                                                                                                    | Relative formula mass | Mass of substance (g) | Number of moles of substance                                                                                                                                                                                                                                                                                                                                                                                                                                             | Number of molecules    |                       |                       |                                                                                             |                     |                |                                                                                     |   |  |                                                                                                              |                |  |   |     |                                                 |                  |    |  |  |                        |   |     |                                                                           |
| O <sub>2</sub>                                                                                               |                       |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                        |                       |                       |                                                                                             |                     |                |                                                                                     |   |  |                                                                                                              |                |  |   |     |                                                 |                  |    |  |  |                        |   |     |                                                                           |
| H <sub>2</sub>                                                                                               |                       | 4                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1.2 x 10 <sup>24</sup> |                       |                       |                                                                                             |                     |                |                                                                                     |   |  |                                                                                                              |                |  |   |     |                                                 |                  |    |  |  |                        |   |     |                                                                           |
| H <sub>2</sub> O                                                                                             | 18                    |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3.0 x 10 <sup>23</sup> |                       |                       |                                                                                             |                     |                |                                                                                     |   |  |                                                                                                              |                |  |   |     |                                                 |                  |    |  |  |                        |   |     |                                                                           |
|                                                                                                              |                       | (iii)                 | <table><tr><td></td><td>true</td><td>false</td></tr><tr><td>The total number of reactant molecules is the same as the total number of product molecules</td><td></td><td>✓</td></tr><tr><td>The total number of reactant atoms is the same as the total number of product atoms</td><td>✓</td><td></td></tr><tr><td>The number of each type of atom in the reactants is equal to the number of each type of atom in the products</td><td>✓</td><td></td></tr></table> ✓✓ |                        | true                  | false                 | The total number of reactant molecules is the same as the total number of product molecules |                     | ✓              | The total number of reactant atoms is the same as the total number of product atoms | ✓ |  | The number of each type of atom in the reactants is equal to the number of each type of atom in the products | ✓              |  | 2 | 2.1 | three correct = 2 marks<br>two correct = 1 mark |                  |    |  |  |                        |   |     |                                                                           |
|                                                                                                              | true                  | false                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                        |                       |                       |                                                                                             |                     |                |                                                                                     |   |  |                                                                                                              |                |  |   |     |                                                 |                  |    |  |  |                        |   |     |                                                                           |
| The total number of reactant molecules is the same as the total number of product molecules                  |                       | ✓                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                        |                       |                       |                                                                                             |                     |                |                                                                                     |   |  |                                                                                                              |                |  |   |     |                                                 |                  |    |  |  |                        |   |     |                                                                           |
| The total number of reactant atoms is the same as the total number of product atoms                          | ✓                     |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                        |                       |                       |                                                                                             |                     |                |                                                                                     |   |  |                                                                                                              |                |  |   |     |                                                 |                  |    |  |  |                        |   |     |                                                                           |
| The number of each type of atom in the reactants is equal to the number of each type of atom in the products | ✓                     |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                        |                       |                       |                                                                                             |                     |                |                                                                                     |   |  |                                                                                                              |                |  |   |     |                                                 |                  |    |  |  |                        |   |     |                                                                           |
|                                                                                                              | (b)                   | (i)                   | <b>FIRST CHECK THE ANSWER ON ANSWER LINE</b><br><b>If answer = 3 award 3 marks</b><br><br>6.2 ÷ 31 = 0.2 ✓<br>21.3 ÷ 71 = 0.3 ✓<br>0.2:0.3 = 2:3 ratio, so 2 moles react with <u>3</u> moles ✓                                                                                                                                                                                                                                                                           | 3                      | 2.2                   |                       |                                                                                             |                     |                |                                                                                     |   |  |                                                                                                              |                |  |   |     |                                                 |                  |    |  |  |                        |   |     |                                                                           |
|                                                                                                              |                       | (ii)                  | Mass of product unchanged ✓<br>phosphorus is limiting factor/ no phosphorus left to react with extra chlorine ✓                                                                                                                                                                                                                                                                                                                                                          | 2                      | 2.1                   |                       |                                                                                             |                     |                |                                                                                     |   |  |                                                                                                              |                |  |   |     |                                                 |                  |    |  |  |                        |   |     |                                                                           |

| Question |     |       | Answer                                                                                                                                                                       | Marks | AO element          | Guidance                                                                                                                                                                           |
|----------|-----|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9        | (a) | (i)   | All contain H <sup>+</sup> ions ✓<br>All have pH less than 7 ✓                                                                                                               | 2     | 2.1                 | <b>ALLOW</b> any reference to hydrogen ions<br><b>IGNORE</b> low pH                                                                                                                |
|          |     | (ii)  | pH = 3 ✓<br>H <sup>+</sup> concentration = 1 x 10 <sup>-3</sup> (mol dm <sup>-3</sup> ) ✓                                                                                    | 2     | 2.2                 |                                                                                                                                                                                    |
|          | (b) | (i)   | Strong acid is fully dissociated into H <sup>+</sup> ions ✓<br><br>Weak acid is partially dissociated into H <sup>+</sup> ions ✓                                             | 2     | 1.1                 | <b>ALLOW</b> 1 mark if difference in dissociation given<br>but no reference to H <sup>+</sup> ions                                                                                 |
|          |     | (ii)  | Hydrochloric acid – concentration same as hydrogen ion concentration ✓<br>Ethanoic acid - concentration bigger than hydrogen ion concentration ✓                             | 2     | 3.1a                | <b>ALLOW</b> 1 mark for ethanoic acid has lower concentration of H <sup>+</sup> ions than hydrochloric acid when concentration of the 2 acids is 0.1 mol/dm <sup>3</sup> /the same |
|          | (c) | (i)   | $\text{Mg} + 2\text{H}^+ \rightarrow \text{Mg}^{2+} + \text{H}_2$ ✓✓                                                                                                         | 2     | 2.1                 | <b>ALLOW</b> 1 mark if formulae correct but not balanced.                                                                                                                          |
|          |     | (ii)  | A is faster than B and C ✓<br>B and C are the same / not very different ✓<br><br>(support - ) Shorter time means faster rate/data to support their conclusions/comparisons ✓ | 3     | 3.2b x2<br><br>3.1a |                                                                                                                                                                                    |
|          |     | (iii) | Rate depends on concentration of hydrogen ions ✓<br>(support) - Hydrogen ion concentration much lower for D ✓                                                                | 2     | 2.1                 |                                                                                                                                                                                    |

| Question |     |       | Answer                                                                                                                                                                                                                                                                              | Marks | AO element | Guidance                                                               |
|----------|-----|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------|------------------------------------------------------------------------|
| 10       | (a) |       | Sodium ions gain electrons <b>AND</b> chloride ions lose electrons ✓<br>Loss of electrons is oxidation <b>AND</b> gain of electrons is reduction ✓<br>Sodium ions are reduced <b>AND</b> chloride ions are oxidised ✓                                                               | 3     | 1.2        |                                                                        |
|          | (b) | (i)   | solution in beaker with label 'sodium chloride solution' with electrodes in solution <b>AND</b> power source or battery ✓<br><br><b>AND</b><br>Power source or battery connected to electrodes with no gaps in the circuit ✓<br><b>OR</b><br>inverted test tubes to collect gases ✓ | 2     | 1.2        |                                                                        |
|          |     | (ii)  | Hydrogen ions $\text{H}^+$ ✓<br>Hydroxide ions $\text{OH}^-$ ✓                                                                                                                                                                                                                      | 2     | 2.2        | <b>ALLOW</b> both correct names or both correct formulae for 1 mark.   |
|          |     | (iii) | sodium is more reactive than hydrogen ✓<br>(in solution) hydrogen ions from water form hydrogen ✓<br>when molten sodium ions are the only (positive) ion / no hydrogen ions ✓                                                                                                       | 3     | 2.2        |                                                                        |
|          |     | (iv)  | (Holding a piece of) damp blue litmus paper just inside the open mouth of the test tube/in a test tube of the gas ✓<br>The test should show that the blue litmus paper turns red, then bleaches white. ✓                                                                            | 2     | 1.2        | <b>ALLOW</b> damp starch-iodide paper turning from white to blue-black |

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