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# **GCSE MARKING SCHEME**

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**SUMMER 2023**

**GCSE  
CHEMISTRY - UNIT 1**

**3410U10-1  
3410UA0-1**

## **INTRODUCTION**

This marking scheme was used by WJEC for the 2023 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

# **GCSE CHEMISTRY UNIT 1: CHEMICAL SUBSTANCES, REACTIONS AND ESSENTIAL RESOURCES**

## **SUMMER 2023 MARK SCHEME**

### **GENERAL INSTRUCTIONS**

#### Recording of marks

Examiners must mark in red ink.

One tick must equate to one mark (except for the extended response question).

Question totals should be written in the box at the end of the question.

Question totals should be entered onto the grid on the front cover and these should be added to give the script total for each candidate.

#### Marking rules

All work should be seen to have been marked.

Marking schemes will indicate when explicit working is deemed to be a necessary part of a correct answer.

Crossed out responses not replaced should be marked.

Credit will be given for correct and relevant alternative responses which are not recorded in the mark scheme.

#### Extended response question

A level of response mark scheme is used. Before applying the mark scheme please read through the whole answer from start to finish. Firstly, decide which level descriptor matches best with the candidate's response: remember that you should be considering the overall quality of the response. Then decide which mark to award within the level. Award the higher mark in the level if there is a good match with both the content statements and the communication statement.

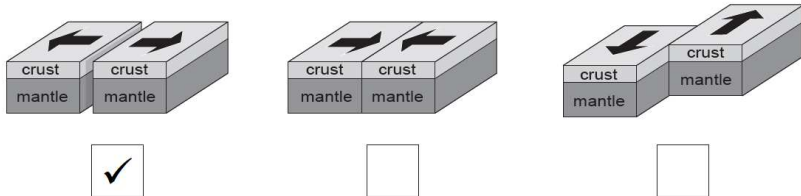
### Marking abbreviations

The following may be used in marking schemes or in the marking of scripts to indicate reasons for the marks awarded.

|     |   |                       |
|-----|---|-----------------------|
| cao | = | correct answer only   |
| ecf | = | error carried forward |
| bod | = | benefit of doubt      |

| Question |     |      |  | Marking details                                                                                                                                                                                                                                                                              | Marks available |          |          |          |          |          |
|----------|-----|------|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------|----------|----------|----------|----------|
|          |     |      |  |                                                                                                                                                                                                                                                                                              | AO1             | AO2      | AO3      | Total    | Maths    | Prac     |
| 1        | (a) | (i)  |  | distillation (1)<br>chromatography (1)                                                                                                                                                                                                                                                       | 2               |          |          | 2        |          | 2        |
|          |     | (ii) |  | <b>A</b> (1)<br><b>B</b> (1)<br><b>D</b> (1)                                                                                                                                                                                                                                                 |                 | 3        |          | 3        |          | 3        |
|          | (b) |      |  | <div>The solid stays the same <input type="checkbox"/></div> <div>A gas is formed <input checked="" type="checkbox"/></div> <div>A temperature change occurs <input checked="" type="checkbox"/></div> <div>The mass of the beaker and contents stay the same <input type="checkbox"/></div> | 2               |          |          | 2        |          | 2        |
|          |     |      |  | <b>Question 1 total</b>                                                                                                                                                                                                                                                                      | <b>4</b>        | <b>3</b> | <b>0</b> | <b>7</b> | <b>0</b> | <b>7</b> |

| Question |     |  |  | Marking details                                                                                                                                            | Marks available |          |          |          |          |          |
|----------|-----|--|--|------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------|----------|----------|----------|----------|
|          |     |  |  |                                                                                                                                                            | AO1             | AO2      | AO3      | Total    | Maths    | Prac     |
| 2        | (a) |  |  | true (1)<br>true (1)<br>false (1)<br>false (1)                                                                                                             | 2               | 2        |          | 4        |          |          |
|          | (b) |  |  | 70 (2)<br>if incorrect award (1) for any clear indication of correct number of atoms of each element e.g.<br>$(2 \times B) + (3 \times O) / 2(11) + 3(16)$ |                 | 2        |          | 2        | 2        |          |
|          | (c) |  |  | <b>A</b>                                                                                                                                                   |                 | 1        |          | 1        |          |          |
|          | (d) |  |  | MgF <sub>2</sub>                                                                                                                                           |                 | 1        |          | 1        |          |          |
|          |     |  |  | <b>Question 2 total</b>                                                                                                                                    | <b>2</b>        | <b>6</b> | <b>0</b> | <b>8</b> | <b>2</b> | <b>0</b> |

| Question |     |       |  | Marking details                                                                    | Marks available |          |          |          |          |          |
|----------|-----|-------|--|------------------------------------------------------------------------------------|-----------------|----------|----------|----------|----------|----------|
|          |     |       |  |                                                                                    | AO1             | AO2      | AO3      | Total    | Maths    | Prac     |
| 3        | (a) | (i)   |  | <b>B</b>                                                                           |                 |          | 1        | 1        |          |          |
|          |     | (ii)  |  | 20                                                                                 |                 | 1        |          | 1        | 1        |          |
|          |     | (iii) |  | <b>Z</b>                                                                           |                 | 1        |          | 1        |          |          |
|          | (b) | (i)   |  |  | 1               |          |          | 1        |          |          |
|          |     | (ii)  |  | magma (1)<br>convection currents (1)                                               | 2               |          |          | 2        |          |          |
|          | (c) |       |  | 4                                                                                  |                 |          | 1        | 1        |          |          |
|          |     |       |  | <b>Question 3 total</b>                                                            | <b>3</b>        | <b>2</b> | <b>2</b> | <b>7</b> | <b>1</b> | <b>0</b> |

| Question |     |       |  | Marking details                                                                                                                                                                                                                                                                                        | Marks available |     |     |       |       |      |
|----------|-----|-------|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----|-----|-------|-------|------|
|          |     |       |  |                                                                                                                                                                                                                                                                                                        | AO1             | AO2 | AO3 | Total | Maths | Prac |
| 4        | (a) |       |  | $\text{Mg} + \text{HCl} \longrightarrow \text{MgCl}_2 + \text{H}$ <input type="checkbox"/><br>$\text{Mg} + 2\text{HCl} \longrightarrow \text{MgCl}_2 + 2\text{H}$ <input type="checkbox"/><br>$\text{Mg} + 2\text{HCl} \longrightarrow \text{MgCl}_2 + \text{H}_2$ <input checked="" type="checkbox"/> |                 | 1   |     | 1     |       |      |
|          | (b) | (i)   |  | award (2) for all points plotted correctly – tolerance $\pm 1$ square<br>award (1) for any three points plotted correctly<br>award (1) for (smooth) curve drawn through points judgement by eye<br>ecf possible from incorrectly plotted points                                                        |                 | 3   |     | 3     | 3     |      |
|          |     | (ii)  |  | decreases<br>increases                                                                                                                                                                                                                                                                                 |                 |     | 2   | 2     |       |      |
|          |     | (iii) |  | more (1)<br>a greater (1)                                                                                                                                                                                                                                                                              | 2               |     |     | 2     |       |      |

| Question |  |      |  | Marking details                        |                                     | Marks available |     |     |       |       |      |
|----------|--|------|--|----------------------------------------|-------------------------------------|-----------------|-----|-----|-------|-------|------|
|          |  |      |  |                                        |                                     | AO1             | AO2 | AO3 | Total | Maths | Prac |
|          |  | (iv) |  | Increasing the temperature of the acid | <input checked="" type="checkbox"/> |                 |     |     |       |       |      |
|          |  |      |  | Using a lump of magnesium              | <input type="checkbox"/>            |                 |     |     |       |       |      |
|          |  |      |  | Using a different apparatus            | <input type="checkbox"/>            |                 |     | 2   | 2     |       | 2    |
|          |  |      |  | Using magnesium powder                 | <input checked="" type="checkbox"/> |                 |     |     |       |       |      |
|          |  |      |  | Decreasing the temperature of the acid | <input type="checkbox"/>            |                 |     |     |       |       |      |
|          |  |      |  | Question 4 total                       |                                     | 2               | 4   | 4   | 10    | 3     | 2    |

| Question |     |      |  | Marking details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Marks available |     |     |       |       |      |
|----------|-----|------|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----|-----|-------|-------|------|
|          |     |      |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | AO1             | AO2 | AO3 | Total | Maths | Prac |
| 5        | (a) | (i)  |  | award (1) for each correct product<br><br>CaO<br><br>CO <sub>2</sub><br><br>ignore any attempt at balancing                                                                                                                                                                                                                                                                                                                                                                                                                    |                 | 2   |     | 2     |       |      |
|          |     | (ii) |  | Ca(OH) <sub>2</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 | 1   |     | 1     |       |      |
|          | (b) |      |  | <b>Indicative content</b><br><br><b>Economic benefits</b> <ul style="list-style-type: none"> <li>• employment / local jobs</li> <li>• building material e.g. roads / houses</li> <li>• raw material e.g. blast furnace / glass / concrete / cement</li> <li>• improved road system</li> </ul> <b>Environmental drawbacks</b> <ul style="list-style-type: none"> <li>• noise e.g. blasting / traffic</li> <li>• dust from blasts / dust from lorries</li> <li>• landscape destruction</li> <li>• habitat destruction</li> </ul> | 6               |     |     | 6     |       |      |

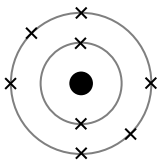
| Question |  |  |  | Marking details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Marks available |     |     |       |       |      |
|----------|--|--|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----|-----|-------|-------|------|
|          |  |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | AO1             | AO2 | AO3 | Total | Maths | Prac |
|          |  |  |  | <p><b>5-6 marks</b><br/>Good description of benefits and drawbacks<br/><i>There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.</i></p> <p><b>3-4 marks</b><br/>Description including reference to some benefits and drawbacks<br/><i>There is a line of reasoning which is partially coherent, largely relevant, supported by some evidence and with some structure. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.</i></p> <p><b>1-2 marks</b><br/>Simple benefit / drawback identified<br/><i>There is a basic line of reasoning which is not coherent, largely irrelevant, supported by limited evidence and with very little structure. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.</i></p> <p><b>0 marks</b><br/>No attempt made or no response worthy of credit</p> |                 |     |     |       |       |      |
|          |  |  |  | Question 5 total                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 6               | 3   | 0   | 9     | 0     | 0    |

| Question |     |       |  | Marking details                                                                                                                                                                                                                                                                                             | Marks available |     |     |       |       |      |
|----------|-----|-------|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----|-----|-------|-------|------|
|          |     |       |  |                                                                                                                                                                                                                                                                                                             | AO1             | AO2 | AO3 | Total | Maths | Prac |
| 6        | (a) | (i)   |  | award (1) for correct order<br><br>zinc carbonate<br>copper(II) carbonate<br>lead carbonate<br><br>accept zinc / Zn<br>accept copper / Cu<br>accept lead / Pb                                                                                                                                               |                 |     | 1   | 1     |       | 1    |
|          |     | (ii)  |  | Sodium carbonate only decomposes a small amount on heating <input type="checkbox"/><br>Sodium carbonate is very unstable <input type="checkbox"/><br>Sodium carbonate does not decompose on heating <input checked="" type="checkbox"/><br>Sodium carbonate decomposes too quickly <input type="checkbox"/> |                 |     | 1   | 1     |       | 1    |
|          |     | (iii) |  | 70 (2)<br><br>if incorrect award (1) for $\frac{3.5}{5.0} / 0.7$                                                                                                                                                                                                                                            |                 | 2   |     | 2     | 2     |      |
|          |     | (iv)  |  | Cu <sup>2+</sup>                                                                                                                                                                                                                                                                                            |                 | 1   |     | 1     |       |      |
|          | (b) |       |  | yellow / orange / yellow-orange                                                                                                                                                                                                                                                                             | 1               |     |     | 1     |       | 1    |
|          |     |       |  | Question 6 total                                                                                                                                                                                                                                                                                            | 1               | 3   | 2   | 6     | 2     | 3    |

| Question |     |       |  | Marking details                                                                              | Marks available |     |     |       |       |      |
|----------|-----|-------|--|----------------------------------------------------------------------------------------------|-----------------|-----|-----|-------|-------|------|
|          |     |       |  |                                                                                              | AO1             | AO2 | AO3 | Total | Maths | Prac |
| 7        | (a) | (i)   |  | Helium is a gas <input type="checkbox"/>                                                     |                 |     |     |       |       |      |
|          |     |       |  | Helium is the second most common element in the Universe <input type="checkbox"/>            |                 |     |     |       |       |      |
|          |     |       |  | Helium is less dense than air <input checked="" type="checkbox"/>                            |                 |     | 1   | 1     |       |      |
|          |     |       |  | Helium is colourless <input type="checkbox"/>                                                |                 |     |     |       |       |      |
|          |     | (ii)  |  | The Earth's atmosphere contains more helium than argon <input type="checkbox"/>              |                 |     |     |       |       |      |
|          |     |       |  | The Earth's atmosphere contains more xenon than helium <input type="checkbox"/>              |                 | 1   |     | 1     | 1     |      |
|          |     |       |  | The Earth's atmosphere contains more helium than krypton <input checked="" type="checkbox"/> |                 |     |     |       |       |      |
|          |     | (iii) |  | There isn't much helium in the Earth's atmosphere <input type="checkbox"/>                   |                 |     |     |       |       |      |
|          |     |       |  | Scientists say helium shouldn't be used to fill balloons <input type="checkbox"/>            |                 |     | 1   | 1     |       |      |
|          |     |       |  | Helium is a finite resource <input checked="" type="checkbox"/>                              |                 |     |     |       |       |      |

| Question |     |      |  | Marking details                                                                                                                                                                                                                                                                                                                                                         | Marks available |          |          |          |          |          |
|----------|-----|------|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------|----------|----------|----------|----------|
|          |     |      |  |                                                                                                                                                                                                                                                                                                                                                                         | AO1             | AO2      | AO3      | Total    | Maths    | Prac     |
|          |     | (iv) |  | <div>Only helium gas can leak away into space <input type="checkbox"/></div> <div>Helium and neon gases can leak away into space <input checked="" type="checkbox"/></div> <div>Only argon can leak away into space <input type="checkbox"/></div> <div>All inert gases can leak away into space <input type="checkbox"/></div>                                         |                 |          | 1        | 1        | 1        |          |
|          | (b) |      |  | <div>All Group 0 elements have 2 electrons in their inner shell <input type="checkbox"/></div> <div>All Group 0 elements have 8 electrons in their outer shell <input type="checkbox"/></div> <div>All Group 0 elements have full outer shells <input checked="" type="checkbox"/></div> <div>All Group 0 elements have some full shells <input type="checkbox"/></div> | 1               |          |          | 1        |          |          |
|          |     |      |  | <b>Question 7 total</b>                                                                                                                                                                                                                                                                                                                                                 | <b>1</b>        | <b>1</b> | <b>3</b> | <b>5</b> | <b>2</b> | <b>0</b> |

| Question |     |       |  | Marking details                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Marks available |          |          |          |          |          |
|----------|-----|-------|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------|----------|----------|----------|----------|
|          |     |       |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | AO1             | AO2      | AO3      | Total    | Maths    | Prac     |
| 8        | (a) |       |  | <b>B</b><br><b>C</b><br><b>A</b><br><br>award (2) for all three correct<br>award (1) for any one correct                                                                                                                                                                                                                                                                                                                                                            |                 |          | 2        | 2        |          | 2        |
|          | (b) |       |  | award (1) for disadvantage relating to soap / scum <ul style="list-style-type: none"> <li>forms scum with soap</li> <li>wastes soap / doesn't lather with soap</li> </ul><br>award (1) for disadvantage relating to limescale <ul style="list-style-type: none"> <li>forms limescale in kettles / boilers</li> <li>furs pipes</li> <li>furring of kettles</li> <li>reduces efficiency of kettles / boilers</li> </ul><br>neutral answers – blocks pipes / bad taste |                 |          | 2        | 2        |          |          |
|          | (c) | (i)   |  | award (1) for either of following <ul style="list-style-type: none"> <li>at 35°C the solubility is 66 g (in 100 g of water) /</li> <li>66 g dissolves at 35°C</li> </ul>                                                                                                                                                                                                                                                                                            |                 | 1        |          | 1        | 1        | 1        |
|          |     | (ii)  |  | 26 (2)<br><br>if incorrect award (1) for either of following <ul style="list-style-type: none"> <li>solubility 79 read from graph</li> <li>53 subtracted from value read from graph to get corresponding answer</li> </ul>                                                                                                                                                                                                                                          |                 | 2        |          | 2        | 2        | 2        |
|          |     | (iii) |  | 40      accept value in the range 39-41                                                                                                                                                                                                                                                                                                                                                                                                                             |                 | 1        |          | 1        | 1        | 1        |
|          |     |       |  | <b>Question 8 total</b>                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>0</b>        | <b>4</b> | <b>4</b> | <b>8</b> | <b>4</b> | <b>6</b> |

| Question |     |      |  | Marking details                                                                   | Marks available |          |          |          |          |          |
|----------|-----|------|--|-----------------------------------------------------------------------------------|-----------------|----------|----------|----------|----------|----------|
|          |     |      |  |                                                                                   | AO1             | AO2      | AO3      | Total    | Maths    | Prac     |
| 9/1      | (a) |      |  | <b>A (1)</b><br><b>B (1)</b><br><b>F (1)</b><br><b>D (1)</b>                      | 1               | 1        |          | 4        |          |          |
|          | (b) |      |  |  |                 | 1        |          | 1        |          |          |
|          | (c) | (i)  |  | number of protons 15<br>number of neutrons 20<br>number of electrons 19           | 3               |          |          | 3        |          |          |
|          |     | (ii) |  | isotopes                                                                          | 1               |          |          | 1        |          |          |
|          |     |      |  | <b>Question 9/1 total</b>                                                         | <b>6</b>        | <b>3</b> | <b>0</b> | <b>9</b> | <b>0</b> | <b>0</b> |

| Question |     |       |  | Marking details                                                                                                                                                                                                                         | Marks available |     |     |       |       |      |
|----------|-----|-------|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----|-----|-------|-------|------|
|          |     |       |  |                                                                                                                                                                                                                                         | AO1             | AO2 | AO3 | Total | Maths | Prac |
| 10/2     | (a) | (i)   |  | award (1) for any of following <ul style="list-style-type: none"> <li>they have same number of electrons in their outer shell</li> <li>they have 1 electron in their outer shell</li> <li>they lose 1 electron when reacting</li> </ul> | 1               |     |     | 1     |       |      |
|          |     | (ii)  |  | density                                                                                                                                                                                                                                 |                 |     | 1   | 1     |       |      |
|          | (b) | (i)   |  | stored in oil / liquid paraffin<br><br>do not accept paraffin                                                                                                                                                                           | 1               |     |     | 1     |       | 1    |
|          |     | (ii)  |  | sodium hydroxide / NaOH (1)<br><br>hydrogen / H <sub>2</sub> (1)                                                                                                                                                                        | 2               |     |     | 2     |       |      |
|          |     | (iii) |  | lithium / Li                                                                                                                                                                                                                            | 1               |     |     | 1     |       |      |
|          |     | (iv)  |  | NaF                                                                                                                                                                                                                                     |                 | 1   |     | 1     |       |      |
|          | (c) | (i)   |  | 61 (2)<br><br>if incorrect award (1) for any of following figures in method or as final answer<br>114<br>0.61 / 0.606<br>10.1 / 10                                                                                                      |                 | 2   |     | 2     | 2     |      |
|          |     | (ii)  |  | mass medication / medical treatment without permission / no choice<br><br>neutral answers<br>any health problem<br>not needed because it's in toothpaste                                                                                | 1               |     |     | 1     |       |      |

| Question |  |       |  | Marking details                                                                                      | Marks available |     |     |       |       |      |
|----------|--|-------|--|------------------------------------------------------------------------------------------------------|-----------------|-----|-----|-------|-------|------|
|          |  |       |  |                                                                                                      | AO1             | AO2 | AO3 | Total | Maths | Prac |
|          |  | (iii) |  | toothpaste<br><br>accept mouthwash<br><br>neutral answers<br>dental products<br>fluoride supplements | 1               |     |     | 1     |       |      |
|          |  |       |  | Question 10/2 total                                                                                  | 7               | 3   | 1   | 11    | 2     | 1    |

| Question |     |      |    | Marking details                                                                                                                                                                                                                                                                                                                                                                                                                   | Marks available |          |          |          |          |          |
|----------|-----|------|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------|----------|----------|----------|----------|
|          |     |      |    |                                                                                                                                                                                                                                                                                                                                                                                                                                   | AO1             | AO2      | AO3      | Total    | Maths    | Prac     |
| 3        | (a) | (i)  | I  | evaporation / boiling<br>condensation                                                                                                                                                                                                                                                                                                                                                                                             | 2               |          |          | 2        |          | 2        |
|          |     |      | II | distillation<br>neutral answer – desalination                                                                                                                                                                                                                                                                                                                                                                                     | 1               |          |          | 1        |          | 1        |
|          |     | (ii) |    | <ul style="list-style-type: none"> <li>water (front) travels up paper / is absorbed (1)</li> </ul> award (1) for any of following <ul style="list-style-type: none"> <li>more soluble dye travels further up paper</li> <li>dyes travel (up paper) at different speeds</li> <li>dyes travel different distances</li> <li>dyes have different <math>R_f</math> values</li> </ul> neutral answer – dyes have different solubilities |                 | 2        |          | 2        |          | 2        |
|          | (b) | (i)  |    | 14                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |          | 1        | 1        |          |          |
|          |     | (ii) |    | 38°C (3)<br>if answer is incorrect award (1) each for any of following<br>solubility at 55°C = 94 g<br>94 – 36 = 58 g<br>ecf possible                                                                                                                                                                                                                                                                                             |                 |          | 3        | 3        | 3        |          |
|          |     |      |    | <b>Question 3 total</b>                                                                                                                                                                                                                                                                                                                                                                                                           | <b>3</b>        | <b>2</b> | <b>4</b> | <b>9</b> | <b>3</b> | <b>5</b> |

| Question |     |       |  | Marking details                                                                                                                                                                                                                                                   | Marks available |          |          |          |          |          |
|----------|-----|-------|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------|----------|----------|----------|----------|
|          |     |       |  |                                                                                                                                                                                                                                                                   | AO1             | AO2      | AO3      | Total    | Maths    | Prac     |
| 4        | (a) | (i)   |  | decomposition                                                                                                                                                                                                                                                     | 1               |          |          | 1        |          |          |
|          |     | (ii)  |  | award (1) for each of following <ul style="list-style-type: none"> <li>steam formed / spits / fizzing / bubbles / effervescence</li> <li>(chip) expands / puffs up / cracks open / breaks up / crumbles</li> </ul> neutral answers<br>gas given off<br>exothermic | 2               |          |          | 2        |          | 2        |
|          |     | (iii) |  | reactant CaO<br>product Ca(OH) <sub>2</sub> both needed for (1)<br>ignore any attempt at balancing                                                                                                                                                                |                 | 1        |          | 1        |          |          |
|          | (b) | (i)   |  | 0.040 (2)<br>if incorrect award (1) for $\frac{2.96}{74}$ in method                                                                                                                                                                                               |                 | 2        |          | 2        | 2        |          |
|          |     | (ii)  |  | calcium hydroxide is an alkali / a base / has pH 11 (1)<br>accept pH values from 8-14<br>neutralises acid in soil (1)<br>accept removes acidity from soil / cancels out acid in soil / raises pH of soil                                                          | 2               |          |          | 2        |          | 2        |
|          |     |       |  | <b>Question 4 total</b>                                                                                                                                                                                                                                           | <b>5</b>        | <b>3</b> | <b>0</b> | <b>8</b> | <b>2</b> | <b>4</b> |

| Question |     |  |  | Marking details                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Marks available |          |          |          |          |          |
|----------|-----|--|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------|----------|----------|----------|----------|
|          |     |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | AO1             | AO2      | AO3      | Total    | Maths    | Prac     |
| 5        | (a) |  |  | $\text{Na}_2\text{CO}_3$                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 | 1        |          | 1        |          |          |
|          | (b) |  |  | 1:2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                 | 1        |          | 1        | 1        |          |
|          | (c) |  |  | <b>3 (1)</b> must have correct number to access second mark<br><br>award (1) for any of following <ul style="list-style-type: none"> <li>limescale is calcium carbonate</li> <li>no calcium carbonate is formed</li> <li>no calcium <b>ions</b></li> <li>removes the ions that form limescale / sodium ions don't form limescale</li> <li><u>only</u> sodium hydrogencarbonate is formed</li> <li>sodium hydrogencarbonate is soluble</li> <li>nothing insoluble is formed</li> </ul> | 2               |          |          | 2        |          |          |
|          | (d) |  |  | calcium sulfate <input checked="" type="checkbox"/><br><br>potassium sulfate <input type="checkbox"/><br><br>magnesium hydrogencarbonate <input type="checkbox"/><br><br>sodium sulfate <input type="checkbox"/>                                                                                                                                                                                                                                                                      | 1               |          |          | 1        |          | 1        |
|          |     |  |  | <b>Question 5 total</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>3</b>        | <b>2</b> | <b>0</b> | <b>5</b> | <b>1</b> | <b>1</b> |

| Question |     |  |  | Marking details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Marks available |     |     |       |       |      |
|----------|-----|--|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----|-----|-------|-------|------|
|          |     |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | AO1             | AO2 | AO3 | Total | Maths | Prac |
| 6        | (a) |  |  | <p><b>Indicative content</b></p> <p>amount of water vapour decreased<br/>as Earth cooled, water vapour condensed and oceans formed</p> <p>amount of carbon dioxide decreased<br/>evolution of green plants,<br/>photosynthesis, CO<sub>2</sub> taken in by plants / algae<br/>evolution of marine animals / CO<sub>2</sub> locked in limestone / chalk / carbonates rock<br/>remains of marine organisms / (land) plants locked into fossil fuels</p> <p>amount of oxygen increased<br/>evolution of green plants, photosynthesis, O<sub>2</sub> released by plants</p> <p><b>5-6 marks</b><br/>Good explanation of changes for all three gases<br/><i>There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.</i></p> <p><b>3-4 marks</b><br/>Basic explanation of changes referring to photosynthesis and condensation of water vapour<br/><i>There is a line of reasoning which is partially coherent, largely relevant, supported by some evidence and with some structure. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.</i></p> <p><b>1-2 marks</b><br/>Simple description of changes in percentage of gases<br/><i>There is a basic line of reasoning which is not coherent, largely irrelevant, supported by limited evidence and with very little structure. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.</i></p> <p><b>0 marks</b><br/>No attempt made or no response worthy of credit</p> | 6               |     |     | 6     |       |      |

| Question |     |       |  | Marking details                                                                                                | Marks available |          |          |          |          |          |
|----------|-----|-------|--|----------------------------------------------------------------------------------------------------------------|-----------------|----------|----------|----------|----------|----------|
|          |     |       |  |                                                                                                                | AO1             | AO2      | AO3      | Total    | Maths    | Prac     |
|          | (b) | (i)   |  | No significant impact on the overall level of carbon dioxide <input checked="" type="checkbox"/>               |                 |          |          |          |          |          |
|          |     |       |  | A significant increase in the level of carbon dioxide <input type="checkbox"/>                                 |                 |          | 1        | 1        |          |          |
|          |     |       |  | A significant decrease in the level of carbon dioxide <input type="checkbox"/>                                 |                 |          |          |          |          |          |
|          |     | (ii)  |  | Mean atmospheric temperature decreases <input checked="" type="checkbox"/>                                     |                 |          |          |          |          |          |
|          |     |       |  | Mean atmospheric temperature increases <input type="checkbox"/>                                                |                 |          | 1        | 1        |          |          |
|          |     |       |  | No effect on the mean atmospheric temperature <input type="checkbox"/>                                         |                 |          |          |          |          |          |
|          |     | (iii) |  | Solar radiation decreases because it is reflected by sulfur dioxide <input checked="" type="checkbox"/>        |                 |          |          |          |          |          |
|          |     |       |  | Solar radiation increases because it is absorbed by carbon dioxide <input type="checkbox"/>                    |                 |          |          |          |          |          |
|          |     |       |  | Solar radiation increases because it is absorbed by carbon dioxide and sulfur dioxide <input type="checkbox"/> |                 |          | 1        | 1        |          |          |
|          |     |       |  | Solar radiation decreases because it reacts with sulfur dioxide forming sulfuric acid <input type="checkbox"/> |                 |          |          |          |          |          |
|          |     |       |  | <b>Question 6 total</b>                                                                                        | <b>6</b>        | <b>0</b> | <b>3</b> | <b>9</b> | <b>0</b> | <b>0</b> |

| Question |     |      |  | Marking details                                                                                                                                                                                                                                                                                                                                                      | Marks available |     |     |       |       |      |
|----------|-----|------|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----|-----|-------|-------|------|
|          |     |      |  |                                                                                                                                                                                                                                                                                                                                                                      | AO1             | AO2 | AO3 | Total | Maths | Prac |
| 7        | (a) |      |  | award (1) for either of following <ul style="list-style-type: none"> <li>prevents acid (-spray) escaping</li> <li><u>only</u> allows carbon dioxide to escape</li> </ul>                                                                                                                                                                                             |                 |     | 1   | 1     |       | 1    |
|          | (b) |      |  | take the mass (after 10 s) away from 107.75 / the original mass                                                                                                                                                                                                                                                                                                      |                 |     | 1   | 1     |       | 1    |
|          | (c) |      |  | 0.0082 / $8.2 \times 10^{-3}$ (3) <b>must</b> be to 2 sig figs<br><br>if incorrect award (1) each for either of following<br><br>appropriate <b>change</b> in mass e.g. 0.44 – 0.30 / 0.14<br><br>corresponding <b>change</b> in time e.g. 30 – 13 / 17<br><br>ecf possible from error in graph reading but must have calculated a change in mass and change in time |                 | 3   |     | 3     | 3     |      |
|          | (d) | (i)  |  | award (2) for all points plotted correctly – tolerance $\pm \frac{1}{2}$ square<br>award (1) for any four points plotted correctly<br><br>award (1) for (smooth) curve drawn through points<br><br>ecf possible from incorrectly plotted points                                                                                                                      |                 | 3   |     | 3     | 3     |      |
|          |     | (ii) |  | acid has lower concentration (1)<br><br>so fewer particles present (in the same volume) (1)<br><br>lower chance of successful collisions / lower frequency of successful collisions / fewer successful collisions (per second) (1)                                                                                                                                   | 2               |     | 1   | 3     |       |      |

| Question |     |  |  | Marking details                                                                                                                             | Marks available |     |     |       |       |      |
|----------|-----|--|--|---------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----|-----|-------|-------|------|
|          |     |  |  |                                                                                                                                             | AO1             | AO2 | AO3 | Total | Maths | Prac |
|          | (e) |  |  | curve to the left of and above graph <b>A</b><br>starting from (0,0) and to a maximum height of 0.88<br>– tolerance $\pm\frac{1}{2}$ square |                 |     | 1   | 1     |       |      |
|          |     |  |  | Question 7 total                                                                                                                            | 2               | 6   | 4   | 12    | 6     | 2    |

| Question |     |      |  | Marking details                                                                                                                                                                                                                                                  | Marks available |     |     |       |       |      |
|----------|-----|------|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----|-----|-------|-------|------|
|          |     |      |  |                                                                                                                                                                                                                                                                  | AO1             | AO2 | AO3 | Total | Maths | Prac |
| 8        | (a) | (i)  |  | increases                                                                                                                                                                                                                                                        |                 |     | 1   | 1     |       |      |
|          |     | (ii) |  | outer shell gets further away (from the nucleus) / there are more shells (1)<br><br>there is lower attraction for an (incoming) electron / it is harder to gain an electron (1)                                                                                  | 2               |     |     | 2     |       |      |
|          | (b) |      |  | $\text{Cl}_2 + 2\text{NaBr} \rightarrow \text{Br}_2 + 2\text{NaCl}$<br><br>award (1) each for formulae<br><br>$\text{Cl}_2$<br>$\text{NaCl}$<br><br>award (1) for balancing only if both formulae are correct                                                    |                 | 3   |     | 3     |       |      |
|          | (c) | (i)  |  | 3.20                                                                                                                                                                                                                                                             |                 | 1   |     | 1     | 1     |      |
|          |     | (ii) |  | $\frac{1.27}{63.5} \quad \frac{3.20}{80} \quad (1)$<br><br>$0.02 : 0.04 \Rightarrow 1 : 2 \Rightarrow \text{CuBr}_2 (1)$<br><br>working <b>must</b> be shown<br><br>ecf possible<br><br>alternative method<br><br>percentage composition of <b>both</b> elements |                 | 2   |     | 2     | 2     | 2    |

| Question |  |  |  | Marking details                                                                                                                                                                                                                           | Marks available |     |     |       |       |      |
|----------|--|--|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----|-----|-------|-------|------|
|          |  |  |  |                                                                                                                                                                                                                                           | AO1             | AO2 | AO3 | Total | Maths | Prac |
|          |  |  |  | $\frac{1.27}{4.47} \times 100 = 28\%$<br>$\frac{3.20}{4.47} \times 100 = 72\% \quad (1)$<br>for 100 g of compound<br>$\frac{28}{63.5} \quad \frac{72}{80}$<br>$0.44 : 0.90 \Rightarrow 1:2 \Rightarrow \text{CuBr}_2 (1)$<br>ecf possible |                 |     |     |       |       |      |
|          |  |  |  | Question 8 total                                                                                                                                                                                                                          | 2               | 6   | 1   | 9     | 3     | 2    |

| Question |     |      |  | Marking details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Marks available |     |     |       |       |      |
|----------|-----|------|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----|-----|-------|-------|------|
|          |     |      |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | AO1             | AO2 | AO3 | Total | Maths | Prac |
| 9        | (a) | (i)  |  | <p>potassium / <math>K^+</math><br/>bromide / <math>Br^-</math>      do not accept bromine</p> <p>calcium / <math>Ca^{2+}</math><br/>iodide / <math>I^-</math>      do not accept iodine</p> <p>award (3) for all four ions correct<br/>award (2) for any two correct<br/>award (1) for any one correct</p>                                                                                                                                                                                                         |                 |     | 3   | 3     |       | 3    |
|          |     | (ii) |  | $BaCl_2$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 | 1   |     | 1     |       |      |
|          | (b) |      |  | <p><math>Na^+(aq) + NO_3^-(aq) \longrightarrow AgCl(s)</math> <input type="checkbox"/></p> <p><math>Ag^+(aq) + NO_3^-(aq) + Na^+(aq) + Cl^-(aq) \longrightarrow NaNO_3(s) + AgCl(s)</math> <input type="checkbox"/></p> <p><math>Ag^+(aq) + NO_3^-(aq) \longrightarrow AgNO_3(s)</math> <input type="checkbox"/></p> <p><math>Ag^+(aq) + Cl^-(aq) \longrightarrow AgCl(s)</math> <input checked="" type="checkbox"/></p> <p><math>Ag^+(aq) + Cl^-(aq) \longrightarrow NaNO_3(s)</math> <input type="checkbox"/></p> |                 | 1   |     | 1     |       |      |

| Question |     |  |  | Marking details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Marks available |     |     |       |       |      |
|----------|-----|--|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----|-----|-------|-------|------|
|          |     |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | AO1             | AO2 | AO3 | Total | Maths | Prac |
|          | (c) |  |  | <p>from the equation</p> <p>552 g of <math>\text{Ag}_2\text{CO}_3</math> gives 432 g of Ag (1)</p> <p>1 g of <math>\text{Ag}_2\text{CO}_3</math> gives <math>\frac{432}{552}</math> g of Ag (1)</p> <p>13.8 g of <math>\text{Ag}_2\text{CO}_3</math> <math>\frac{432}{552} \times 13.8</math> g of Ag = 10.8 g (1)</p> <p>ecf possible</p> <p>alternative method</p> <p>moles of <math>\text{Ag}_2\text{CO}_3 = \frac{13.8}{276} = 0.05</math> mol (1)</p> <p>2 mol of <math>\text{Ag}_2\text{CO}_3</math> gives 4 mol of Ag</p> <p>therefore 0.10 mol of Ag produced (1)</p> <p>mass of Ag = <math>n \times M_r = 0.10 \times 108 = 10.8</math> g (1)</p> <p>ecf possible</p> <p>second alternative method (applying conservation of mass)</p> <p>percentage of Ag in <math>\text{Ag}_2\text{CO}_3 = \frac{216}{276} \times 100 = 78.3\%</math> (1)</p> <p>mass of Ag on left-hand side = <math>\frac{78.3}{100} \times 13.8 = 10.8</math> g (1)</p> <p>so 10.8 g of Ag formed (1)</p> <p>ecf possible</p> |                 | 3   |     | 3     | 3     |      |
|          |     |  |  | Question 9 total                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0               | 5   | 3   | 8     | 3     | 3    |

## FOUNDATION TIER

### SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

| Question     | AO1       | AO2       | AO3       | TOTAL MARK | MATHS     | PRAC      |
|--------------|-----------|-----------|-----------|------------|-----------|-----------|
| <b>1</b>     | 4         | 3         | 0         | <b>7</b>   | 0         | 7         |
| <b>2</b>     | 2         | 6         | 0         | <b>8</b>   | 2         | 0         |
| <b>3</b>     | 3         | 2         | 2         | <b>7</b>   | 1         | 0         |
| <b>4</b>     | 2         | 4         | 4         | <b>10</b>  | 3         | 2         |
| <b>5</b>     | 6         | 3         | 0         | <b>9</b>   | 0         | 0         |
| <b>6</b>     | 1         | 3         | 2         | <b>6</b>   | 2         | 3         |
| <b>7</b>     | 1         | 1         | 3         | <b>5</b>   | 2         | 0         |
| <b>8</b>     | 0         | 4         | 4         | <b>8</b>   | 4         | 6         |
| <b>9</b>     | 6         | 3         | 0         | <b>9</b>   | 0         | 0         |
| <b>10</b>    | 7         | 3         | 1         | <b>11</b>  | 2         | 1         |
| <b>Total</b> | <b>32</b> | <b>32</b> | <b>16</b> | <b>80</b>  | <b>16</b> | <b>19</b> |

## HIGHER TIER

### SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

| Question     | AO1       | AO2       | AO3       | TOTAL MARK | MATHS     | PRAC      |
|--------------|-----------|-----------|-----------|------------|-----------|-----------|
| <b>1</b>     | 6         | 3         | 0         | <b>9</b>   | 0         | 0         |
| <b>2</b>     | 7         | 3         | 1         | <b>11</b>  | 2         | 1         |
| <b>3</b>     | 3         | 2         | 4         | <b>9</b>   | 3         | 5         |
| <b>4</b>     | 5         | 3         | 0         | <b>8</b>   | 2         | 4         |
| <b>5</b>     | 3         | 2         | 0         | <b>5</b>   | 1         | 1         |
| <b>6</b>     | 6         | 0         | 3         | <b>9</b>   | 0         | 0         |
| <b>7</b>     | 2         | 6         | 4         | <b>12</b>  | 6         | 2         |
| <b>8</b>     | 2         | 6         | 1         | <b>9</b>   | 3         | 2         |
| <b>9</b>     | 0         | 5         | 3         | <b>8</b>   | 3         | 3         |
| <b>Total</b> | <b>34</b> | <b>30</b> | <b>16</b> | <b>80</b>  | <b>20</b> | <b>18</b> |