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# **GCSE MARKING SCHEME**

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**SUMMER 2019**

**GCSE (NEW)  
SCIENCE (DOUBLE AWARD) - UNIT 2**

**3430U20-1  
3430UB0-1**

## **INTRODUCTION**

This marking scheme was used by WJEC for the 2019 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 SCIENCE (DOUBLE AWARD) UNIT 2 – CHEMISTRY 1

### MARK SCHEME

#### GENERAL INSTRUCTIONS

##### 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 statements.

##### 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      |

### Foundation Tier only questions

| Question |  |  |  | Marking details                   | Marks available |     |     |       |       |      |
|----------|--|--|--|-----------------------------------|-----------------|-----|-----|-------|-------|------|
|          |  |  |  |                                   | AO1             | AO2 | AO3 | Total | Maths | Prac |
| 1        |  |  |  | award (1) for each correct answer |                 |     |     |       |       |      |
|          |  |  |  | E (accept calcium)                | 1               |     |     |       |       |      |
|          |  |  |  | A (accept hydrogen)               |                 | 1   |     |       |       | 1    |
|          |  |  |  | C (accept silicon)                |                 | 1   |     |       |       |      |
|          |  |  |  | D (accept chlorine)               |                 | 1   |     |       |       |      |
|          |  |  |  | B (accept neon)                   | 1               |     |     | 5     |       | 1    |
|          |  |  |  | Question 1 total                  | 2               | 3   | 0   | 5     | 0     | 2    |

| Question |     |       |  | Marking details                                                                        | Marks available |          |          |          |          |          |
|----------|-----|-------|--|----------------------------------------------------------------------------------------|-----------------|----------|----------|----------|----------|----------|
|          |     |       |  |                                                                                        | AO1             | AO2      | AO3      | Total    | Maths    | Prac     |
| 2        | (a) | (i)   |  | <b>C</b> (1)<br>neutral answer - hydrogen<br><br>it contains one type of atom only (1) |                 | 2        |          | 2        |          |          |
|          |     | (ii)  |  | <b>D</b>                                                                               |                 |          | 1        | 1        |          |          |
|          |     | (iii) |  |       |                 |          | 1        | 1        |          |          |
|          | (b) | (i)   |  | 52.5                                                                                   |                 | 1        |          | 1        | 1        |          |
|          |     | (ii)  |  | 50 (2)<br><br>if answer incorrect award (1) for $\frac{32}{64}$                        |                 | 2        |          | 2        | 2        |          |
|          | (c) |       |  | $2\text{P} + 3\text{H}_2 \rightarrow 2\text{PH}_3$                                     |                 | 1        |          | 1        |          |          |
|          |     |       |  | <b>Question 2 total</b>                                                                | <b>0</b>        | <b>6</b> | <b>2</b> | <b>8</b> | <b>3</b> | <b>0</b> |

| Question |     |  |  | Marking details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Marks available |          |          |          |          |          |
|----------|-----|--|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------|----------|----------|----------|----------|
|          |     |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | AO1             | AO2      | AO3      | Total    | Maths    | Prac     |
| 3        | (a) |  |  | beta-carotene, chlorophyll and betalain<br><br><b>and</b><br><br>each one has only one spot on the chromatogram                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 | 1        |          | 1        |          |          |
|          | (b) |  |  | award (1) for each correct answer<br><br><div>             chlorophyll is not present in carrot, tomato or beetroot extracts             <input checked="" type="checkbox"/> </div> <div>             beta-carotene is present in carrot extract but not present in tomato extract             <input type="checkbox"/> </div> <div>             both beta-carotene and betalain are present in beetroot extract             <input checked="" type="checkbox"/> </div> <div>             betalain is present in tomato extract but not present in carrot extract             <input type="checkbox"/> </div> <div>             both carrot and beetroot extracts contain a pigment other than beta-carotene, chlorophyll and betalain             <input type="checkbox"/> </div> max (1) if three boxes ticked<br>0 if four or more boxes ticked |                 |          | 2        | 2        |          | 2        |
|          | (c) |  |  | 0.55 (2)<br><br>if answer incorrect award (1) for $\frac{4.4}{8}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1               | 1        |          | 2        | 2        | 2        |
|          | (d) |  |  | one pigment in beetroot extract is insoluble (in the solvent used)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 | 1        |          | 1        |          | 1        |
|          |     |  |  | <b>Question 3 total</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>1</b>        | <b>3</b> | <b>2</b> | <b>6</b> | <b>2</b> | <b>5</b> |

| Question |     |       |  | Marking details                                                                                                                                                                                                 | Marks available |          |          |          |          |          |
|----------|-----|-------|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------|----------|----------|----------|----------|
|          |     |       |  |                                                                                                                                                                                                                 | AO1             | AO2      | AO3      | Total    | Maths    | Prac     |
| 4        | (a) |       |  | magma rises through the gap (1)<br><br>award (1) for any of following <ul style="list-style-type: none"> <li>magma then cools to form new rock / mid-ocean ridge</li> <li>magma then forms a volcano</li> </ul> | 2               |          |          | 2        |          |          |
|          | (b) | (i)   |  | oceanic plate is denser/heavier than the continental plate                                                                                                                                                      | 1               |          |          | 1        |          |          |
|          |     | (ii)  |  | oceanic plate melts / turns to magma / turns to molten rock<br><br>earthquakes occur / new mountain ranges form - neutral answers                                                                               | 1               |          |          | 1        |          |          |
|          |     | (iii) |  | destructive                                                                                                                                                                                                     | 1               |          |          | 1        |          |          |
|          | (c) |       |  | 0.895 / 0.90 / 0.9      (2)<br><br>if answer incorrect award (1) for $\frac{537}{600}$                                                                                                                          | 1               | 1        |          | 2        | 2        |          |
|          |     |       |  | <b>Question 4 total</b>                                                                                                                                                                                         | <b>6</b>        | <b>1</b> | <b>0</b> | <b>7</b> | <b>2</b> | <b>0</b> |

| Question |     |  |  | Marking details                         | Marks available                     |     |     |       |       |      |
|----------|-----|--|--|-----------------------------------------|-------------------------------------|-----|-----|-------|-------|------|
|          |     |  |  |                                         | AO1                                 | AO2 | AO3 | Total | Maths | Prac |
| 5        | (a) |  |  | its density is 1.7 g/cm <sup>3</sup>    | <input type="checkbox"/>            |     |     |       |       |      |
|          |     |  |  | its melting point is 650 °C             | <input type="checkbox"/>            |     |     |       |       |      |
|          |     |  |  | it fizzes vigorously with sulfuric acid | <input checked="" type="checkbox"/> |     | 1   | 1     |       | 1    |
|          |     |  |  | it is malleable                         | <input type="checkbox"/>            |     |     |       |       |      |
|          | (b) |  |  | it does not react with sulfuric acid    | <input type="checkbox"/>            |     |     |       |       |      |
|          |     |  |  | it is ductile                           | <input type="checkbox"/>            |     |     |       |       |      |
|          |     |  |  | it would melt when it lands on planet J | <input checked="" type="checkbox"/> |     | 1   | 1     |       |      |
|          |     |  |  | its density is 11.3 g/cm <sup>3</sup>   | <input type="checkbox"/>            |     |     |       |       |      |

| Question |     |  |  | Marking details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Marks available |     |     |       |       |      |
|----------|-----|--|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----|-----|-------|-------|------|
|          |     |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | AO1             | AO2 | AO3 | Total | Maths | Prac |
|          | (c) |  |  | award (1) for each correct answer<br><br>it does not react with sulfuric acid <input checked="" type="checkbox"/><br><br>it is expensive <input type="checkbox"/><br><br>it is a good conductor of heat <input type="checkbox"/><br><br>it is non-magnetic <input type="checkbox"/><br><br>it has a melting point much higher than the temperature on planet J <input checked="" type="checkbox"/><br><br>it is shiny so will reflect the sun's rays <input type="checkbox"/><br><br>if three boxes ticked each incorrect answer negates a correct one<br>0 if four or more boxes ticked |                 |     | 2   | 2     |       |      |
|          | (d) |  |  | <b>2Na + H<sub>2</sub>SO<sub>4</sub> → Na<sub>2</sub>SO<sub>4</sub> + H<sub>2</sub></b><br><br>award (1) for correct formula Na <sub>2</sub> SO <sub>4</sub><br><br>award (1) for balancing <b>only</b> if Na <sub>2</sub> SO <sub>4</sub> given                                                                                                                                                                                                                                                                                                                                         |                 | 2   |     | 2     | 1     |      |
|          |     |  |  | Question 5 total                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0               | 2   | 4   | 6     | 1     | 1    |

| Question |  |  |  | Marking details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Marks available |          |          |          |          |          |
|----------|--|--|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------|----------|----------|----------|----------|
|          |  |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | AO1             | AO2      | AO3      | Total    | Maths    | Prac     |
| 6        |  |  |  | <p><b>Indicative content</b></p> <p>Benefit - fluoride reduces tooth decay / results in less fillings in teeth</p> <p>Reasons to oppose</p> <ul style="list-style-type: none"> <li>• can have possible side effects on health e.g. brittle bones, infertility, kidney problems, stomach cancer, birth defects</li> <li>• can cause fluorosis - teeth going yellow</li> <li>• unethical - fluoride added to drinking water without public consent / mass medication</li> <li>• fluoride is toxic in high concentrations</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 6               |          |          | 6        |          |          |
|          |  |  |  | <p><b>5-6 marks</b><br/>Detailed description of benefit and peoples' concerns; includes at least two health side effects; describes ethical argument<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/>Good description of benefit and peoples' concerns; mentions one health side effect; mentions ethical argument<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/>Brief description of benefit; mentions one health side effect or ethical argument<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/><i>No attempt made or no response worthy of credit.</i></p> |                 |          |          |          |          |          |
|          |  |  |  | <b>Question 6 total</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>6</b>        | <b>0</b> | <b>0</b> | <b>6</b> | <b>0</b> | <b>0</b> |

| Question |     |      |  | Marking details                                                                                                                                                                                                                                | Marks available |     |     |       |       |      |
|----------|-----|------|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----|-----|-------|-------|------|
|          |     |      |  |                                                                                                                                                                                                                                                | AO1             | AO2 | AO3 | Total | Maths | Prac |
| 7        | (a) |      |  | mass decreases (with time) (1)<br><br>due to carbon dioxide / gas being released (and lost to the atmosphere) (1)                                                                                                                              |                 |     | 2   | 2     |       | 2    |
|          | (b) | (i)  |  | 3 minutes                                                                                                                                                                                                                                      |                 | 1   |     | 1     | 1     | 1    |
|          |     | (ii) |  | <div>from 0 – 0.5 minutes <input checked="" type="checkbox"/></div> <div>from 1 – 1.5 minutes <input type="checkbox"/></div> <div>from 2 – 2.5 minutes <input type="checkbox"/></div> <div>from 3 – 3.5 minutes <input type="checkbox"/></div> |                 |     | 1   | 1     |       | 1    |
|          | (c) |      |  | 1.5 (2)<br><br>if answer incorrect award (1) for 100 – 97                                                                                                                                                                                      |                 | 2   |     | 2     | 2     |      |
|          | (d) |      |  | curve drawn above / to the right of original curve<br><br>does not have to reach 96.8 if still falling<br>must start at 100 and not go below 96.8                                                                                              |                 |     | 1   | 1     |       | 1    |
|          |     |      |  | Question 7 total                                                                                                                                                                                                                               | 0               | 3   | 4   | 7     | 3     | 5    |

### Common questions

| Question |     |       |  | Marking details                                                                                                                                                                                                          | Marks available |          |          |          |          |          |
|----------|-----|-------|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------|----------|----------|----------|----------|
|          |     |       |  |                                                                                                                                                                                                                          | AO1             | AO2      | AO3      | Total    | Maths    | Prac     |
| 8/1      | (a) |       |  | 2,8,7 (1)<br><br>phosphorus (1)<br><br>4 (1)                                                                                                                                                                             |                 | 3        |          | 3        |          |          |
|          | (b) | (i)   |  | award (1) for any of following <ul style="list-style-type: none"> <li>• lilac flame</li> <li>• moves</li> <li>• floats</li> <li>• melts / forms ball</li> <li>• bubbles of gas / effervescence</li> </ul>                | 1               |          |          | 1        |          | 1        |
|          |     | (ii)  |  | award (1) for any of following <ul style="list-style-type: none"> <li>• use a safety screen</li> <li>• add only a small piece of potassium</li> <li>• use excess water</li> <li>• use tongs to hold potassium</li> </ul> | 1               |          |          | 1        |          | 1        |
|          |     | (iii) |  | KOH                                                                                                                                                                                                                      |                 | 1        |          | 1        |          |          |
|          |     | (iv)  |  | 11/12/13/14<br>accept any value 8-14                                                                                                                                                                                     |                 | 1        |          | 1        |          | 1        |
|          |     | (v)   |  | award (1) for any of following <ul style="list-style-type: none"> <li>• rubidium</li> <li>• caesium</li> <li>• francium</li> </ul>                                                                                       | 1               |          |          | 1        |          |          |
|          |     |       |  | <b>Question 8/1 total</b>                                                                                                                                                                                                | <b>3</b>        | <b>5</b> | <b>0</b> | <b>8</b> | <b>0</b> | <b>3</b> |

| Question |     |      |  | Marking details                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Marks available |     |     |       |       |      |
|----------|-----|------|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----|-----|-------|-------|------|
|          |     |      |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | AO1             | AO2 | AO3 | Total | Maths | Prac |
| 9/2      | (a) | (i)  |  | temperature decreased (1)<br>water vapour condensed to form oceans (1)                                                                                                                                                                                                                                                                                                                                                                                           | 2               |     |     | 2     |       |      |
|          |     | (ii) |  | award (1) each for any two of following <ul style="list-style-type: none"> <li>(green) plants evolved which carried out photosynthesis</li> <li>carbon dioxide absorbed by the oceans</li> <li>carbon dioxide absorbed by shells of marine organisms / trapped in limestone rock</li> <li>carbon dioxide trapped in fossil fuels</li> </ul>                                                                                                                      | 2               |     |     | 2     |       |      |
|          | (b) |      |  | increase in percentage of carbon dioxide due to burning of fossil fuels / deforestation (1)<br><br>award (1) for any of following <ul style="list-style-type: none"> <li>climate change</li> <li><u>more</u> extreme weather</li> <li><u>more</u> drought conditions</li> <li>polar ice caps melting at a <u>higher rate</u></li> <li>rising sea levels</li> <li><u>more</u> flooding</li> <li>loss of wildlife habitat</li> </ul> accept other sensible answers | 2               |     |     | 2     |       |      |
|          | (c) |      |  | $4\text{NH}_3 + 3\text{O}_2 \rightarrow 2\text{N}_2 + 6\text{H}_2\text{O}$                                                                                                                                                                                                                                                                                                                                                                                       |                 | 1   |     | 1     | 1     |      |
|          |     |      |  | Question 9/2 total                                                                                                                                                                                                                                                                                                                                                                                                                                               | 6               | 1   | 0   | 7     | 1     | 0    |

### Higher Tier only questions

| Question |     |  |  | Marking details                                                                                                                                                                                                                        | Marks available |          |          |          |          |          |
|----------|-----|--|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------|----------|----------|----------|----------|
|          |     |  |  |                                                                                                                                                                                                                                        | AO1             | AO2      | AO3      | Total    | Maths    | Prac     |
| 3        | (a) |  |  | <b>A</b> – barium bromide (1)<br><b>B</b> – lithium chloride (1)<br><b>C</b> – sodium iodide (1)<br><br>accept correct formulae<br><br>if not all correct<br>award (2) for any four correct ions<br>award (1) for any two correct ions |                 |          | 3        | 3        |          | 3        |
|          | (b) |  |  | $\text{MgCl}_2 + 2\text{AgNO}_3 \rightarrow 2\text{AgCl} + \text{Mg}(\text{NO}_3)_2$<br><br>award (1) for correct formulae of products<br><br>award (1) for balancing <b>only</b> if correct formulae given                            |                 | 2        |          | 2        |          |          |
|          | (c) |  |  | $M_r(\text{AgNO}_3) = 170 \quad (1)$<br><br>$\frac{0.103}{170} \quad (1)$<br><br>$6.06 \times 10^{-4} \text{ mol} \quad (1)$<br><br>award (2) for 0.000606 mol<br><br>ecf from incorrect $M_r$ value                                   |                 | 3        |          | 3        | 3        |          |
|          |     |  |  | <b>Question 3 total</b>                                                                                                                                                                                                                | <b>0</b>        | <b>5</b> | <b>3</b> | <b>8</b> | <b>3</b> | <b>3</b> |

| Question |     |      |  | Marking details                                                                                                                                                                                                                                    | Marks available |          |          |          |          |          |
|----------|-----|------|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------|----------|----------|----------|----------|
|          |     |      |  |                                                                                                                                                                                                                                                    | AO1             | AO2      | AO3      | Total    | Maths    | Prac     |
| 4        | (a) |      |  | award (1) for any of following <ul style="list-style-type: none"> <li>getting crystals to form</li> <li>temperature below room temperature</li> <li>cooling to 4°C / 10°C</li> </ul> place the boiling tube in ice (1)                             |                 |          | 2        | 2        |          | 2        |
|          | (b) | (i)  |  | all points plotted correctly (2)<br>4/5 points plotted correctly (1)<br>tolerance $\pm\frac{1}{2}$ small square<br><br>suitable straight line / curve drawn (1)                                                                                    |                 | 3        |          | 3        | 3        |          |
|          |     | (ii) |  | no - maximum of around 4.9 g will dissolve at this temperature<br><br>accept any sensible explanation using graph<br><br>ecf possible from incorrect graph plotting / poor line                                                                    |                 |          | 1        | 1        |          | 1        |
|          | (c) |      |  | put 5.0 g sample in 50 g of water and mix/stir well (1)<br>accept any volume which will not dissolve all of the solid<br><br>filter off undissolved solid, dry and weigh (1)<br><br>work out how much dissolved and hence value for solubility (1) | 1               | 1        | 1        | 3        |          | 3        |
|          |     |      |  | <b>Question 4 total</b>                                                                                                                                                                                                                            | <b>1</b>        | <b>4</b> | <b>4</b> | <b>9</b> | <b>3</b> | <b>6</b> |

| Question |     |  |  | Marking details                                                                                                                                                                                                                                                                                                                      | Marks available |     |     |       |       |      |
|----------|-----|--|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----|-----|-------|-------|------|
|          |     |  |  |                                                                                                                                                                                                                                                                                                                                      | AO1             | AO2 | AO3 | Total | Maths | Prac |
| 5        | (a) |  |  | mixture is heated until one liquid boils / evaporates then condenses and is collected in a different container (1)<br><br>liquids must have different boiling points (1)<br><br>liquid <b>E</b> has the lower boiling point so is the one removed / liquid <b>F</b> has the higher boiling point so is the one left in the flask (1) | 3               |     |     | 3     |       | 3    |
|          | (b) |  |  | 74 / 74.1 (2)<br><br>if answer incorrect award (1) for $\frac{32}{43.2} \times 100$                                                                                                                                                                                                                                                  |                 | 2   |     | 2     | 2     |      |
|          |     |  |  | Question 5 total                                                                                                                                                                                                                                                                                                                     | 3               | 2   | 0   | 5     | 2     | 3    |

| Question |  |  |  | Marking details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Marks available |     |     |       |       |      |
|----------|--|--|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----|-----|-------|-------|------|
|          |  |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | AO1             | AO2 | AO3 | Total | Maths | Prac |
| 6        |  |  |  | <p><b>Indicative content</b></p> <ul style="list-style-type: none"> <li>removal of temporary hardness by boiling</li> <li>hydrogencarbonate ions are not thermally stable and decompose easily on heating</li> <li>this forms a layer of calcium carbonate (inside kettles)</li> <li>calcium hydrogencarbonate → calcium carbonate + water + carbon dioxide</li> <li><math>\text{Ca}(\text{HCO}_3)_2 \rightarrow \text{CaCO}_3 + \text{H}_2\text{O} + \text{CO}_2</math></li> <li>boiling does not remove permanent hardness</li> <li>removal of permanent hardness by adding washing soda/sodium carbonate</li> <li>this forms a (white) precipitate</li> <li>sodium carbonate + calcium sulfate → calcium carbonate + sodium sulfate</li> <li><math>\text{Na}_2\text{CO}_3 + \text{CaSO}_4 \rightarrow \text{CaCO}_3 + \text{Na}_2\text{SO}_4</math></li> </ul> <p><b>5-6 marks</b><br/>Detailed description of how hard water is softened using both methods; one correct equation<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/>Good description of how water is softened using both methods<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/>Brief description of how water is softened using one of the methods<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/><i>No attempt made or no response worthy of credit.</i></p> | 6               |     |     | 6     |       | 3    |
|          |  |  |  | Question 6 total                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 6               | 0   | 0   | 6     | 0     | 3    |

| Question |     |      |  | Marking details                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Marks available |     |     |       |       |      |
|----------|-----|------|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----|-----|-------|-------|------|
|          |     |      |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | AO1             | AO2 | AO3 | Total | Maths | Prac |
| 7        | (a) | (i)  |  | chlorine is more reactive than iodine (1)<br>accept chlorine can gain an electron more easily than iodine<br><br>award (1) for any of following <ul style="list-style-type: none"> <li>chlorine displaces iodide ion</li> <li>chlorine takes electron from iodide ion</li> <li>chlorine oxidises iodide ion</li> </ul>                                                                                                                                                           | 2               |     |     | 2     |       | 2    |
|          |     | (ii) |  | $\text{Cl}_2 + 2\text{KI} \rightarrow 2\text{KCl} + \text{I}_2$<br><br>award (1) for correct formulae for reactants and products<br><br>award (1) for balancing <b>only</b> if correct formulae given                                                                                                                                                                                                                                                                            |                 | 2   |     | 2     |       |      |
|          | (b) |      |  | 112 g of iron reacts with 213 g of chlorine (1)<br>1.32 g of iron reacts with $\frac{213}{112} \times 1.32$ g of chlorine (1)<br>2.51 g (1)<br><br>ecf possible for incorrect relative mass values i.e. 112 or 213<br><br>alternative method<br><br>moles Fe = $\frac{1.32}{56} = 0.0236$ mol (1)<br><br>moles $\text{Cl}_2 = \frac{3}{2} \times 0.0236 = 0.0353$ mol (1)<br><br>mass $\text{Cl}_2 = 0.0353 \times 71 = 2.51$ g (1)<br><br>ecf possible for incorrect mole ratio |                 | 3   |     | 3     | 3     |      |

| Question |     |      |  | Marking details                                         | Marks available |     |     |       |       |      |
|----------|-----|------|--|---------------------------------------------------------|-----------------|-----|-----|-------|-------|------|
|          |     |      |  |                                                         | AO1             | AO2 | AO3 | Total | Maths | Prac |
|          | (c) | (i)  |  | $\text{Cl}_2 + 3\text{Br}_2 \rightarrow 2\text{ClBr}_3$ |                 | 1   |     | 1     |       |      |
|          |     | (ii) |  | 77.46 / 77.5 / 77                                       |                 | 1   |     | 1     | 1     |      |
|          |     |      |  | Question 7 total                                        | 2               | 7   | 0   | 9     | 4     | 2    |

| Question |     |  |  | Marking details                                                                                                                                                                                                                                                                                                                                           | Marks available |     |     |       |       |      |
|----------|-----|--|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----|-----|-------|-------|------|
|          |     |  |  |                                                                                                                                                                                                                                                                                                                                                           | AO1             | AO2 | AO3 | Total | Maths | Prac |
| 8        | (a) |  |  | type of oil used, towel material and volume of hydrogen peroxide <input type="checkbox"/><br>type of oil used, towel material and temperature of stain remover <input type="checkbox"/><br>type of oil used and towel material <input checked="" type="checkbox"/><br>type of oil used, towel material and cost of stain remover <input type="checkbox"/> |                 |     | 1   | 1     |       | 1    |
|          | (b) |  |  | it is the cheapest stain remover <input type="checkbox"/><br>it is heat resistant <input type="checkbox"/><br>it has a low concentration of hydrogen peroxide <input checked="" type="checkbox"/><br>it takes a long time to work <input checked="" type="checkbox"/><br><b>both</b> needed for (1)<br>0 if more than two boxes ticked                    |                 |     | 1   | 1     |       | 1    |
|          | (c) |  |  | award (1) for either of following <ul style="list-style-type: none"> <li>stain remover <b>D</b> may have a catalyst added</li> <li>stain remover <b>D</b> may have an enzyme added</li> </ul>                                                                                                                                                             |                 |     | 1   | 1     |       | 1    |

| Question |     |      |  | Marking details                                                                                                                                                                                                                                                                                                                                                                                       | Marks available |          |          |          |          |          |
|----------|-----|------|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------|----------|----------|----------|----------|
|          |     |      |  |                                                                                                                                                                                                                                                                                                                                                                                                       | AO1             | AO2      | AO3      | Total    | Maths    | Prac     |
|          | (d) | (i)  |  | 0.14 / 0.143 (2)<br><br>if answer incorrect award (1) for $\frac{0.4}{2.8}$<br><br>ecf possible for error in reading graph                                                                                                                                                                                                                                                                            |                 |          | 2        | 2        | 2        |          |
|          |     | (ii) |  | concentration <b>S</b> is <b>half</b> of concentration <b>T</b> (1)<br><br><b>half</b> the number of particles in the same volume (1)<br><br><b>half</b> the chance of successful collisions / <b>half</b> the number of successful collisions per second / <b>half</b> the frequency of successful collisions (1)<br><br>award (2) if answered using 'lower' / 'fewer' rather than 'half' throughout | 3               |          |          | 3        |          |          |
|          |     |      |  | <b>Question 8 total</b>                                                                                                                                                                                                                                                                                                                                                                               | <b>3</b>        | <b>0</b> | <b>5</b> | <b>8</b> | <b>2</b> | <b>3</b> |

## FOUNDATION TIER

### SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

| Question     | AO1       | AO2       | AO3       | TOTAL MARK | MATHS     | PRAC      |
|--------------|-----------|-----------|-----------|------------|-----------|-----------|
| 1            | 2         | 3         | 0         | 5          | 0         | 2         |
| 2            | 0         | 6         | 2         | 8          | 3         | 0         |
| 3            | 1         | 3         | 2         | 6          | 2         | 5         |
| 4            | 6         | 1         | 0         | 7          | 2         | 0         |
| 5            | 0         | 2         | 4         | 6          | 1         | 1         |
| 6            | 6         | 0         | 0         | 6          | 0         | 0         |
| 7            | 0         | 3         | 4         | 7          | 3         | 5         |
| 8            | 3         | 5         | 0         | 8          | 0         | 3         |
| 9            | 6         | 1         | 0         | 7          | 1         | 0         |
| <b>TOTAL</b> | <b>24</b> | <b>24</b> | <b>12</b> | <b>60</b>  | <b>12</b> | <b>10</b> |

## HIGHER TIER

### SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

| Question | AO1 | AO2 | AO3 | TOTAL MARK | MATHS | PRAC |
|----------|-----|-----|-----|------------|-------|------|
| 1        | 3   | 5   | 0   | 8          | 0     | 3    |
| 2        | 6   | 1   | 0   | 7          | 1     | 0    |
| 3        | 0   | 5   | 3   | 8          | 3     | 3    |
| 4        | 1   | 4   | 4   | 9          | 3     | 6    |
| 5        | 3   | 2   | 0   | 5          | 2     | 3    |
| 6        | 6   | 0   | 0   | 6          | 0     | 3    |
| 7        | 2   | 7   | 0   | 9          | 4     | 2    |
| 8        | 3   | 0   | 5   | 8          | 2     | 3    |
| TOTAL    | 24  | 24  | 12  | 60         | 15    | 23   |