OCR GCSE GATEWAY CHEMISTRY A · J248

# CHEMISTRY



## MARK SCHEME

### WS1.3 ANALYSIS AND EVALUATION

| SCORE | PERCENTAGE |
| --- | --- |
| /81 | % |

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| Question | | | Answer/Indicative content | Marks | Guidance |
|---|---|---|---|---|---|
| 1 | a | i | A **AND** D ✓ | 1 (AO3.1a) | |
| | | ii | **Any two from:**<br>Conducts electricity in molten state ✓<br><br>Does not conduct electricity in solid state ✓<br><br>High melting point ✓ | 2 (AO3.2b) | ALLOW dissolve in water |
| | b | i | Add water (and stir) ✓<br><br>Filtration ✓<br><br>**B** collects on filter paper ✓ | 3 (AO3.3a<br><br>1.2<br><br>3.3a) | |
| | | ii | Distillation **OR** evaporation **OR** heating ✓<br><br>Removes water **OR** dries C **OR** removes some water and leave to crystalise ✓ | 2 (AO1.2<br><br>3.3a) | **ALLOW** boiling |
| | | | **Total** | **8** | |
| 2 | | i | All points plotted correctly scores 2 mark ✓✓<br><br>Straight line of best fit through the points ✓ | 3 (AO2 × 2.2 1.2) | **ALLOW** ± ½ square<br>3 or 4 points plotted correctly scores 1 mark<br><br>**ALLOW** correctly drawn line of best fit through incorrectly drawn points; this may be a curve |
| | | ii | 0.72 (A) ✓ | 1 (AO3.1a) | **ALLOW** answer in the range 0.70 A – 0.74 A / ecf |

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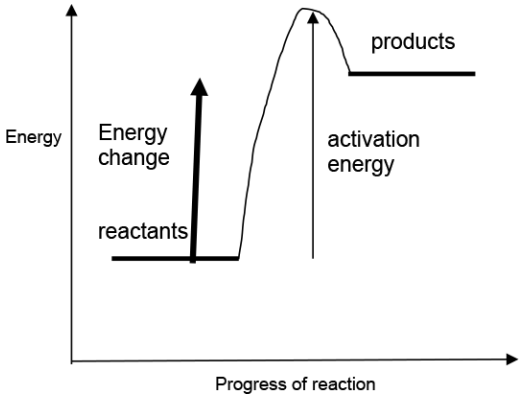
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| Question | | | Answer/Indicative content | Marks | Guidance |
|---|---|---|---|---|---|
| | | iii | FIRST CHECK ANSWER ON ANSWER LINE<br>If answer = 47(g) award 2 marks<br><br>5A = 15.5(g) = 15.5 × 3 = 46.5(g) ✓<br><br>= 47(g) (2 sig. figs) ✓ | 2<br><br>(AO2.1<br><br>1.2) | ALLOW<br>1.0 A = 3.1 (g) (from graph or table)<br>10(A) = 31(g) and 5 (A) = 1.55 (g) ✓<br><br>15(A) = 31 + 1.55 = (46.5) 47 (g) ✓ |
| | | | Total | 6 | |

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<table>
<tr><th colspan="3">Question</th><th>Answer/Indicative content</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>3</td><td></td><td>i</td><td>
<table>
<tr><th>Reaction mixture</th><th>Start temperature (°C)</th><th>End temperature (°C)</th><th>Temperature change (°C)</th></tr>
<tr><td>X</td><td>20.0</td><td>25.5</td><td>(+) 5.5</td></tr>
<tr><td>Y</td><td>19.0</td><td>8.0</td><td>–11</td></tr>
<tr><td>Z</td><td>20.0</td><td>20.0</td><td>0</td></tr>
</table>
</td><td>1<br>(AO1.2)</td><td></td></tr>
<tr><td></td><td></td><td>ii</td><td>Y ✓<br><br>the temperature went down / decreased / energy is taken in ✓</td><td>2<br>(AO3.2b<br><br>1.1)</td><td></td></tr>
<tr><td></td><td></td><td>iii</td><td>

<br><br>Activation energy ✓<br>Energy change ✓<br>Reactants ✓</td><td>3<br>(AO1.1)</td><td>ALLOW max 1 mark for correct shape if labels are missing / incorrect</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>6</td><td></td></tr>
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| Question | | | Answer/Indicative content | Marks | Guidance |
|---|---|---|---|---|---|
| 4 | | i | Germanium ✓ | 1 (AO3.1a) | |
| | | ii | Idea of similar atomic mass / 72.6 is closest to 72 / closest atomic mass ✓<br><br>Idea of similar density / 5.35 is closest to 5.5 / closest density ✓ | 2 (AO3.2a) | **ALLOW** (Relative) atomic mass of 72.6 is very close to 72<br>**IGNORE** just atomic masses are 72 and 72.6<br><br>**ALLOW** density of 5.35 is very close to 5.5<br>**IGNORE** just densities are 5.35 and 5.5<br><br>**IGNORE** comments about melting point or colour<br><br>If no marks awarded **ALLOW** 1 for density and relative atomic mass and not melting point |
| | | | **Total** | **1** | |
| 5 | | i | Germanium ✓ | 1 (AO3.1a) | |
| | | ii | Idea of similar atomic mass / 72.6 is closest to 72 / closest atomic mass ✓<br><br>Idea of similar density / 5.35 is closest to 5.5 / / closest density ✓ | 2 (AO2×3.2a) | **ALLOW** (Relative) atomic mass of 72.6 is very close to 72<br>**IGNORE** just atomic masses are 72 and 72.6<br><br>**ALLOW** density of 5.35 is very close to 5.5<br>**IGNORE** just densities are 5.35 and 5.5<br><br>**IGNORE** comments about melting point or colour<br><br>If no marks awarded, **ALLOW** 1 for density and relative atomic mass and not melting point |
| | | | **Total** | **3** | |

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| Question | | | Answer/Indicative content | Marks | Guidance |
|---|---|---|---|---|---|
| 6 | | | *Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.*<br><br>**Level 3 (5–6 marks)**<br>Detailed evaluation of the advantages and disadvantages of <u>all</u> of the pH testing kits A-E<br>**AND**<br>Suggested pH kit the farmer should use<br>*There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.*<br><br>**Level 2 (3–4 marks)**<br>Evaluation of the advantages and disadvantages of some of the pH testing kits A-E<br>**OR**<br>Detailed evaluation of the advantages of <u>all</u> of the pH testing kits A-E<br>**OR**<br>Detailed evaluation of the disadvantages of <u>all</u> of the pH testing kits A-E<br><u>**AND**</u><br>Suggested pH kit the farmer should use<br><br>**OR**<br>Detailed evaluation of the advantages and disadvantages of <u>all</u> of the pH testing kits A-E<br><br>*There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.*<br><br>**Level 1 (1–2 marks)**<br>Evaluation of the advantages of some of the pH testing kits A-E<br>**OR**<br>Evaluation of the disadvantages of some of the pH testing kits A-E<br>**OR**<br>Evaluation of the advantages and disadvantages of some of the pH testing kits A-E<br><u>**AND**</u> | 6 (AO6 × 3.2a) | **AO3.2a Analyse information and ideas to make a judgement of which pH testing kit the farmer should use**<br><br>**Advantages**<br><br>• **A** is one of the least expensive testing kits<br>• **A** changes colour across the pH scale<br>• **A** can be used in acidic and alkaline soils<br>• **D** is the least expensive<br><br>**Disadvantages**<br><br>• Idea that **B** and **D** only have two possible colours and therefore cannot tell you the pH<br>• Idea that **C** and **E** don't change colour past pH 7, therefore is no use in alkaline soils<br>• **E** is the most expensive<br><br>**Choice**<br><br>• **A** should be used by the farmer |

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| Question | | | Answer/Indicative content | Marks | Guidance |
|---|---|---|---|---|---|
| | | | Suggested pH kit the farmer should use.<br><br>*There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.*<br><br>**0 marks**<br>*No response or no response worthy of credit.* | | |
| | | | **Total** | **6** | |
| 7 | | i | x- axis: mass of copper carbonate (g)<br>**AND**<br>y-axis: mass of copper oxide(g) ✓<br><br>Appropriate scale ✓<br><br>All points plotted correctly ✓<br><br>Line of best fit through the points ✓ | 4<br>(AO4 × 2.2)<br><br>(AO1.2) | **ALLOW** correct formulae, ie $CuCO_3$ and CuO<br>**ALLOW** just copper carbonate (g) **AND** copper oxide(g)<br><br>**ALLOW** ± ½ square<br><br>**ALLOW** line that starts at (1, 0.7) and does not go through (0,0)<br><br>**ALLOW** correctly drawn line of best fit through incorrectly drawn points; this may be a curve |
| | | ii | 3.8(0) (g) ✓ | 1<br>(AO3.1a) | **ALLOW** ± ½ square<br>**ALLOW** ECF from graph |
| | | iii | Idea that carbon dioxide (gas) escapes ✓ | 1<br>AO3.2b) | **ALLOW** idea that a gas is produced / escapes, but **DO NOT ALLOW** incorrectly named gas |
| | | | **Total** | **6** | |
| 8 | | | **B** ✓ | 1<br>(AO1.2) | |
| | | | **Total** | **1** | |
| 9 | | | **A** ✓ | 1<br>(AO2.2) | |
| | | | **Total** | **1** | |

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| Question | | | Answer/Indicative content | Marks | Guidance |
|---|---|---|---|---|---|
| 10 | | | C ✓ | 1 (AO2.2) | |
| | | | **Total** | **1** | |
| 11 | | | Fluorine – **gas** ✓<br><br>Astatine – Radius in the range **0.148 - 0.210** ✓ | 2 (AO1.1) (AO3.2a) | |
| | | | **Total** | **2** | |
| 12 | a | | Potassium / $K^+$ ✓ | 1 (AO1.2) | |
| | b | i | Carbonate / $CO_3^{2-}$ ✓ | 1 (AO1.2) | |
| | | ii | (limewater) goes cloudy / milky/white ✓ | 1 (AO1.2) | |
| | c | i | Green ✓ | 1 (AO3.2b) | |
| | | ii | Magnesium most reactive<br>Zinc<br>Iron<br>Copper least reactive<br><br>correct order – 2 marks<br>magnesium as most reactive and copper as least – 1 mark | 2 (AO3.2b) | |
| | | iii | $Mg + CuSO_4 \rightarrow MgSO_4 + Cu$ ✓ | 1 (AO2.2) | **ALLOW** any correct multiple, including fractions<br>**DO NOT ALLOW** and / & instead of '+'<br>**ALLOW** a minor error in subscripts / formulae |
| | | | **Total** | **7** | |

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| Question | | | Answer/Indicative content | Marks | Guidance |
|---|---|---|---|---|---|
| 13 | a | | **Any one from:**<br>Use a single indicator / named single indicator eg methyl orange / phenolphthalein (instead of universal indicator)✓<br>Idea that universal does not give a sudden colour change / universal indicator gives a continuous colour change / ORA ✓<br><br>OR<br><br>Fill the burette exactly to the 0.0 $cm^3$ line ✓<br>Idea that this will give accurate volume of acid ✓<br><br>OR<br><br>Idea of adding acid to the alkali **slowly or dropwise** near the end point ✓<br>As indicator should change colour on addition of one drop (of acid) ✓<br><br>OR<br><br>Idea of swirling the alkali while adding the acid ✓<br>To ensure mixing of acid and alkali ✓<br><br>OR<br><br>Use a white tile under the conical flask ✓<br>To see the colour change easily / clearly ✓ | 2<br>(AO3.3b) | **Explanation must be linked to reason**<br><br>**ALLOW** idea of using a pH probe or pH meter |
| | b | | **FIRST CHECK THE ANSWER ON ANSWER LINE**<br>**If answer = 23.65 ($cm^3$) award 2 marks**<br><br>Use of volume of acid from only titrations 2 & 3 /<br>Use of only 23.60 & 23.70 ✓<br><br>Accurate volume of acid = 23.65 ($cm^3$) ✓ | 2<br>(AO2.2) | **ALLOW** 1 mark for average calculated using all results, ie 24.35 ($cm^3$) |
| | | | **Total** | **4** | |
| 14 | | | (Amount of carbon dioxide) increases / AW ✓ | 1<br>(AO3.1a) | Must have the trend, not just the start and end amounts |
| | | | **Total** | **1** | |

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| Question | | | Answer/Indicative content | Marks | Guidance |
|---|---|---|---|---|---|
| 15 | a | | Any one from:<br>Aluminium is higher in the reactivity series than carbon / aluminium is more reactive than carbon / ORA ✓<br><br>Carbon cannot displace aluminium (from bauxite) /<br>bauxite cannot be reduced by carbon ✓ | 1<br>(AO2.2) | Assume unqualified answers refer to aluminium<br><br>IGNORE aluminium is very reactive<br>Answers must be comparative<br><br>ALLOW bauxite does not react with carbon |
| | b | i | Any two from:<br>Aluminium (metal) is sorted from other metals / materials ✓<br><br>Idea that aluminium / metal is shredded or crushed into smaller pieces ready for processing ✓<br><br>Idea that aluminium / metal is melted (by heating) ✓<br><br>Molten aluminium / metal is poured into moulds ✓ | 2<br>(AO1.1) | DO NOT ALLOW references to electrolysis<br><br>ALLOW idea of cooling to form a solid (again) |
| | | ii | Any three from:<br>Idea that recycling aluminium saves energy (compared to extracting aluminium from bauxite) / ORA ✓<br><br>Idea that recycling makes more aluminium (than extraction from bauxite) ✓<br><br>Aluminium isn't wasted ✓<br><br>Use of data to back up either idea ✓<br><br>Idea of finite resource ✓<br><br>Idea of aluminium not being biodegradable, so recycling reduces landfill ✓<br><br>Idea that recycling aluminium produces less waste material (than extraction from bauxite) / ORA ✓<br><br>Idea that recycling aluminium produces less greenhouse gas emissions (than extraction from bauxite) / ORA ✓ | 3<br>(AO3.2b) | IGNORE just quoting numbers; answer must be comparative<br>IGNORE references to cost<br><br>ALLOW idea that recycling aluminium uses less raw materials |
| | | | Total | 6 | |

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| Question | | | Answer/Indicative content | Marks | Guidance |
|---|---|---|---|---|---|
| 16 | | i | Waxes and tar ✓ | 1 (AO2.1) | |
| | | ii | Waxes and tar ✓ | 1 (AO2.1) | |
| | | | **Total** | **2** | |
| 17 | | | **C ✓** | 1 (AO2.2) | |
| | | | **Total** | **1** | |

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| Question | | | Answer/Indicative content | Marks | Guidance |
|---|---|---|---|---|---|
| 18 | a | | **Any one from:**<br>Aluminium is higher in the reactivity series than carbon / aluminium is more reactive than carbon / ORA ✓<br><br>Carbon cannot displace aluminium (from bauxite) / bauxite cannot be reduced by carbon ✓ | 1<br>(AO2.2) | **Assume unqualified answers refer to aluminium**<br><br>**IGNORE** aluminium is very reactive<br>**Answers must be comparative**<br><br>**ALLOW** bauxite does not react with carbon |
| | b | i | **Any two from:**<br>Aluminium (metal) is sorted from other metals / materials ✓<br><br>Idea that aluminium / metal is shredded or crushed into smaller pieces ready for processing ✓<br><br>Idea that aluminium / metal is melted (by heating) ✓<br><br>Molten aluminium / metal is poured into moulds ✓ | 2<br>(AO1.1) | **DO NOT ALLOW** references to electrolysis<br><br>**ALLOW** idea of cooling to form a solid (again) |
| | | ii | **Any three from:**<br>Idea that recycling aluminium saves energy (compared to extracting aluminium from bauxite) / ORA ✓<br><br>Idea that recycling makes more aluminium (than extraction from bauxite) ✓<br><br>Aluminium isn't wasted ✓<br><br>Use of data to back up either idea ✓<br><br>Idea of finite resource ✓<br><br>Idea of aluminium not being biodegradable, so recycling reduces landfill ✓<br><br>Idea that recycling aluminium produces less waste material (than extraction from bauxite) / ORA ✓<br><br>Idea that recycling aluminium produces less greenhouse gas emissions (than extraction from bauxite) / ORA ✓ | 3<br>(AO3.2b) | **IGNORE** just quoting numbers; answer must be comparative<br>**IGNORE** references to cost<br><br>**ALLOW** idea that recycling aluminium uses less raw materials |
| | | | **Total** | **6** | |

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|---|---|---|---|---|---|
| 19 | | | **Any two from:**<br>Outer electron in rubidium is further from the nucleus / ORA ✓<br><br>Idea that attraction of rubidium's nucleus for outer electron is less / ORA ✓<br><br>Outer electron in rubidium is lost more easily / ORA ✓ | 2<br>(AO1.1) | **Assume unqualified answer refers to rubidium**<br><br>**ALLOW** outer electron in higher energy level / shell<br><br>**ALLOW** more shielding in rubidium<br><br>**IGNORE** idea that outer electron is lost more quickly<br><br>**Reference to outer electron needed at least once** |
| | | | **Total** | 2 | |
| 20 | | | C most reactive<br>A<br>D<br>B least reactive<br>correct order – 2 marks<br>C as most reactive and B as least – 1 mark | 2<br>(AO3.2b) | |
| | | | **Total** | 2 | |
| 21 | | | Idea that both carbon dioxide levels and variation in air temperature shows an increasing trend ✓<br><br>(Therefore) data suggests that carbon dioxide emissions are linked to global warming ✓<br><br>**OR**<br><br>Idea that carbon dioxide levels have increased steadily but variation in air temperature has fluctuated ✓<br><br>(Therefore) data does not support a link between carbon dioxide emissions and global warming ✓ | 2<br>(AO2×3.1 b) | **Evidence and conclusion must be linked**<br>**ALLOW** there is a positive correlation (between carbon dioxide levels and variation in air temperature) |
| | | | **Total** | 2 | |

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| Question | | | Answer/Indicative content | Marks | Guidance |
|---|---|---|---|---|---|
| 22 | | i | All points plotted correctly scores 2 marks<br>**BUT**<br>3 or 4 points plotted correctly scores 1 mark<br><br>Line of best fit through points ✓ | 3<br>(AO2×2.2)<br><br>(AO1.2) | **ALLOW** ± ½ square |
| | | ii | 42s ± 2s ✓ | 1<br>(AO2.2) | **ALLOW** answer ± 2s of graph |
| | | iii | (Rate of reaction) increases ✓ | 1<br>(AO3.1a) | |
| | | iv | **Any two from:**<br>Idea that particles move faster / particles have more energy ✓<br><br>Idea of increased collisions (frequency) between acid and thiosulfate ✓<br><br>Idea of more successful collisions / collisions between acid and thiosulfate are more energetic ✓ | 2<br>(AO2×2.2) | **IGNORE** references to 'faster' collisions |
| | | | **Total** | **7** | |

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