This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners’ meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the May/June 2015 series for most Cambridge IGCSE®, Cambridge International A and AS Level components and some Cambridge O Level components.
<table>
<thead>
<tr>
<th>Question</th>
<th>Mark Scheme</th>
<th>Mark</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (a)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>name of particle</strong></td>
<td><strong>relative mass</strong></td>
<td><strong>relative charge</strong></td>
<td></td>
</tr>
<tr>
<td>proton</td>
<td>1</td>
<td>+1</td>
<td></td>
</tr>
<tr>
<td>electron</td>
<td>1/1836</td>
<td>-1</td>
<td></td>
</tr>
<tr>
<td>neutron</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>(b) (i)</td>
<td>Mass of an atom(s)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>relative to $\frac{1}{12}$th (the mass) of (an atom of) carbon-12 OR relative to carbon-12 which is (exactly) 12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(ii)</td>
<td>% of third isotope = 10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\frac{(24 \times 79) + (26 \times 11.0) + 10x}{100} = 24.3$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$10x = 248$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$x = 24.8$ (3s.f.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(c) (i)</td>
<td>anode $2Cl^- \rightarrow Cl_2 + 2e^-$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>cathode $Mg^{2+} + 2e^- \rightarrow Mg$</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| (ii) | $\begin{array}{cccccc} 
  & Mg & O & H & Cl \\
 31.65 & 20.84 & 1.31 & 35.5 \\
 24.3 & 16 & 1 & 36.2 \\
 \end{array}$ | | | | [1] |
| $\begin{array}{cccccc} 
 1.30 & 1.30 & 1.31 & 1.30 \\
 \end{array}$ | | | | [1] |
<p>| $= 1:1:1:1$ | | | | |
| MgOCl | | | | |
| (d) (i) | Na$_2$O basic/alkaline; Al$_2$O$_3$ amphoteric/acidic and basic; SO$_3$ acidic Na$_2$O (giant) ionic AND SO$_3$ (simple/molecular) covalent | | | [1] [2] |
| (ii) | Na$_2$O + 2HCl $\rightarrow$ 2NaCl + H$_2$O | | | [1] |
| $Al_2O_3 + 6HCl \rightarrow 2AlCl_3 + 3H_2O$ | | | | [1] |
| $Al_2O_3 + 2NaOH + 7H_2O \rightarrow 2NaAl(OH)$_4$(H$_2$O)$_2$ OR $Al_2O_3 + 2NaOH + 3H_2O \rightarrow 2NaAl(OH)$_4$ OR $Al_2O_3 + 2NaOH \rightarrow 2NaAlO_2 + H_2O$ OR $Al_2O_3 + 2OH^- + 7H_2O \rightarrow 2[Al(OH)$_4$(H$_2$O)$_2]$ OR $Al_2O_3 + 2OH^- + 3H_2O \rightarrow 2[Al(OH)$_4$] OR $Al_2O_3 + 2OH^- \rightarrow 2AlO_2^- + H_2O$ | | | | [1] |
| SO$_3$ + NaOH $\rightarrow$ NaHSO$_4$ OR SO$_3$ + 2NaOH $\rightarrow$ Na$_2$SO$_4$ + H$_2$O | | | | [1] [4] |</p>
<table>
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<tbody>
<tr>
<td><strong>2 (a) (i)</strong></td>
<td>$2\text{PbS} + 3\text{O}_2 \rightarrow 2\text{PbO} + 2\text{SO}_2$ reagents and formulae balancing</td>
<td>[1]</td>
<td>[2]</td>
</tr>
<tr>
<td>(ii)</td>
<td>S (is oxidised) –2 to (+)4 O (is reduced) 0 to –2</td>
<td>[1]</td>
<td>[2]</td>
</tr>
<tr>
<td>(b) (i)</td>
<td>$T = 400 – 600 ^\circ \text{C}$ (chosen as a compromise because) High T increases rate ora High T decreases yield/moves eqm left/makes less $\text{SO}_3$ as forward reaction exothermic ora</td>
<td>[1]</td>
<td>[3]</td>
</tr>
<tr>
<td>(ii)</td>
<td>High pressure increases rate as collision frequency increases ora High pressure moves eqm right/favours forward reaction as more moles on left ora Uneconomic to use high pressures/high yield at low pressure</td>
<td>[1]</td>
<td>[3]</td>
</tr>
<tr>
<td>(c) (i)</td>
<td>Reaction (too) exothermic/acid spray produced</td>
<td>[1]</td>
<td>[1]</td>
</tr>
<tr>
<td>(ii)</td>
<td>$\text{SO}_3 + \text{H}_2\text{SO}_4 \rightarrow \text{H}_2\text{S}_2\text{O}_7$ $\text{H}_2\text{S}_2\text{O}_7 + \text{H}_2\text{O} \rightarrow 2\text{H}_2\text{SO}_4$</td>
<td>[1]</td>
<td>[2]</td>
</tr>
<tr>
<td>(d)</td>
<td>Preservative owtte antimicrobial/antioxidant/reducing agent</td>
<td>[1]</td>
<td>[2]</td>
</tr>
<tr>
<td>(e) (i)</td>
<td>$12.35 \times 0.01 / 1000 = 1.235 \times 10^{-4}$</td>
<td>[1]</td>
<td>[1]</td>
</tr>
<tr>
<td>(ii)</td>
<td>$1.235 \times 10^{-4} \times 1000 / 50 = 2.47 \times 10^{-3}$</td>
<td>[1]</td>
<td>[1]</td>
</tr>
<tr>
<td>(iii)</td>
<td>$2.47 \times 10^{-3} \times 64.1 = 0.158327 \text{g} = 158 \text{(3 sf only)}$</td>
<td>[1]</td>
<td>[1]</td>
</tr>
<tr>
<td><strong>3 (a) (i)</strong></td>
<td>Bond breaking = $\text{C-I} = 242$ $\text{C-H} = 410 = 652 \text{kJ}$</td>
<td>[1]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bond forming = $\text{C-Cl} = 340$ $\text{H-Cl} = 431 = 771 \text{kJ}$</td>
<td>[1]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Enthalpy change = $652 – 771 = -119$</td>
<td>[1]</td>
<td>[3]</td>
</tr>
<tr>
<td>(ii)</td>
<td>UV/High T/sunlight</td>
<td>[1]</td>
<td>[1]</td>
</tr>
<tr>
<td>Question</td>
<td>Mark Scheme</td>
<td>Mark</td>
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</tr>
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<td>----------</td>
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</tr>
</tbody>
</table>
| (iii)    | **Initiation**<br>
  Cl<sub>2</sub> → 2Cl<sup>−</sup><br>
  **Propagation**<br>
  C<sub>2</sub>H<sub>6</sub> + Cl<sup>−</sup> → •C<sub>2</sub>H<sub>5</sub> + HCl<br>
  •C<sub>2</sub>H<sub>5</sub> + Cl<sub>2</sub> → C<sub>2</sub>H<sub>5</sub>Cl + Cl<sup>−</sup><br>
  **Termination**<br>
  •C<sub>2</sub>H<sub>5</sub> + •C<sub>2</sub>H<sub>5</sub> → C<sub>4</sub>H<sub>10</sub> | [1] | [5] |
| (b) (i)  | ethene      | [1]  | [1]  |
| (ii)     | KOH/NaOH    | [1]  |      |
|          | ethanolic AND heat/reflux |      | [2]  |
| (iii)    | H<sub>2</sub> AND Pt or Ni (catalyst) | [1] | [1] |
| 4 (a) (i) | A = CH<sub>3</sub>CH<sub>2</sub>CH<sub>2</sub>CHO | [1]  |      |
|          | B = CH<sub>3</sub>CH<sub>2</sub>CH(CH<sub>3</sub>)CHO | [1]  |      |
|          | C = (CH<sub>3</sub>)<sub>2</sub>CHCH<sub>2</sub>CHO | [1]  |      |
|          | D = (CH<sub>3</sub>)<sub>3</sub>CCHO | [1]  | [4]  |
| (ii)     | ![Structure](image) | [1+1] | [2]  |
| (b) (i)  | Fehling’s/Benedict’s OR Tollens’ OR dichromate OR manganate | [1]  |      |
|          | Warm/heat   | [1]  |      |
|          | Fehling’s/Benedict’s = (Brick)-red ppt |      |      |
|          | Tollens’ = silver/mirror OR grey/black precipitate |      |      |
|          | Dichromate = orange to green |      |      |
|          | Manganate = purple to colourless |      |      |
|          | with the aldehyde/A-D |      | [3]  |
| (ii)     | (2,4-)DNP(H)/Brady’s reagent | [1]  |      |
|          | Orange/yellow/red-orange/yellow-orange ppt | [1]  | [2]  |

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