Cambridge
O Level

**Cambridge International Examinations**
Cambridge Ordinary Level

**CHEMISTRY** **5070/22**

Paper 2 Theory **May/June 2017**

MARK SCHEME

Maximum Mark: 75

**Published**

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.

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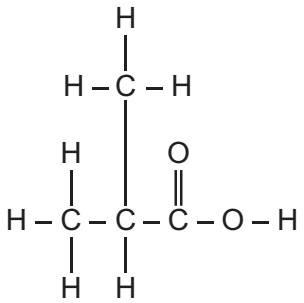
| Question | Answer | Mark |
|---|---|---|
| A1(a) | Copper(II) chloride | **1** |
| A1(b) | Ammonium chloride | **1** |
| A1(c) | Hydrogen chloride | **1** |
| A1(d) | Ammonium chloride | **1** |
| A1(e) | Carbon tetrachloride | **1** |

| Question | Answer | Mark |
|---|---|---|
| A2(a) | <table><tr><th>particle</th><th>atomic number</th><th>number of neutrons in particle</th><th>number of electrons in particle</th></tr><tr><td>$^{35}Cl$</td><td>17</td><td>18</td><td>**17** (1)</td></tr><tr><td>**$^{37}Cl$** (1)</td><td>17</td><td>20</td><td>17</td></tr><tr><td>$^{39}K^{+}$</td><td>19</td><td>**20** (1)</td><td>18</td></tr><tr><td>$^{79}Br^{-}$</td><td>**35** (1)</td><td>44</td><td>36</td></tr><tr><td>$^{81}Br$</td><td>35</td><td>**46** (1)</td><td>35</td></tr><tr><td>**$^{85}Rb^{+}$** (1)</td><td>37</td><td>48</td><td>36</td></tr></table> | **6** |
| A2(b)(i) | Atoms with same number of protons but different number of neutrons / atoms with same atomic number but different nucleon number / atoms of the same element with different number of neutrons | **1** |
| A2(b)(ii) | $^{35}Cl$ and $^{37}Cl$ | **1** |

| Question | Answer | Mark |
|---|---|---|
| A3(a)(i) | Hydrochloric acid **AND** magnesium oxide | **1** |
| A3(a)(ii) | 1 mark each for any 4 of:<br>• Use of **excess** base (1)<br>• Use hot acid / use warm acid / warm the mixture (of acid and base) (1)<br>• Filter mixture (to get filtrate) (1)<br>• Evaporate some of filtrate and allow to crystallise / leave in warm place to crystallise / heat to crystallisation point (1)<br>• (Filter), wash with organic solvent / dry with filter paper / dry in a (drying) oven (1) | **4** |
| A3(b) | $Ba^{2+}(aq) + SO_4^{2-}(aq) \rightarrow BaSO_4(s)$<br><br>Correct formulae and balancing (1)<br>Correct state symbols – dependent on correct formulae (1) | **2** |
| A3(c)(i) | Moles of acid = $0.020 \times 0.65$ **OR** 0.013 (1)<br>Mass = 2.26(2) (g) / 2.3 (g) (1) | **2** |
| A3(c)(ii) | Percentage yield = 76.(1) % | **1** |

| Question | Answer | Mark |
|---|---|---|
| A4(a) | Sodium ion: 2.8 (1)<br>Oxide ion: 2.8 (1) | **2** |
| A(b) | Negative electrode: $Na^+ + e^- \rightarrow Na$ (1)<br>Positive electrode: $2O^{2-} \rightarrow O_2 + 4e^-$ (1) | **2** |
| A(c) | Ions move / mobile ions / ions free to move | **1** |
| A(d) | $Na_2O + H_2O \rightarrow 2NaOH$ | **1** |

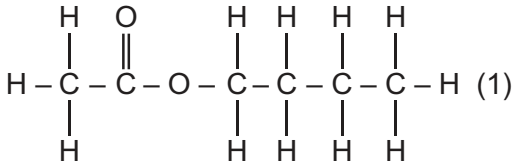
| Question | Answer | Mark |
|---|---|---|
| A5(a) | (Acidified) potassium manganate(VII) / oxygen | **1** |
| A5(b)(i) | Lithium / sodium / potassium / calcium / magnesium (1)<br>Corresponding ethanoate **AND** hydrogen (1) | **2** |
| A5(b)(ii) | $CaCO_3 + 2CH_3CO_2H \rightarrow Ca(CH_3CO_2)_2 + H_2O + CO_2$ (2)<br>IF: two marks not scored $H_2O$ and $CO_2$ as products = 1 mark | **2** |
| A5(c) |  | **1** |
| A5(d)(i) | Condensation | **1** |
| A5(d)(ii) | Decomposes / decays / will not fill up land-fill sites / less litter / no need for incineration | **1** |

| Question | Answer | Mark |
|---|---|---|
| A6(a) | Energy / enthalpy on vertical axis **AND** progress of reaction / course of reaction on horizontal axis (1)<br>Reactant level above product level and to the left of product **AND** reactants and products labelled (1)<br>Enthalpy change shown by downward arrow **AND** labelled enthalpy change or $\Delta H$ (1) | **3** |
| A6(b) | 1 mark each for any **two** of:<br>• Lower activation energy (1)<br>• More particles have energy equal to / greater than the activation energy (1)<br>• Different pathway / different mechanism / via an enzyme complex (1)<br>• more successful collisions (between groups on enzyme and substrates) / number of effective collisions increase (with specific groups on enzyme surface) (1) | **2** |
| A6(c) | Idea that combustion **AND** respiration increase levels of carbon dioxide / carbon in the atmosphere (1)<br>Idea that photosynthesis reduces levels of carbon dioxide / carbon in the atmosphere (1)<br>Idea that these processes balance each other (1) | **3** |

| Question | Answer | Mark |
|---|---|---|
| B7(a) | Blue solution / bubbles | **1** |
| B7(b)(i) | Copper(II) sulfate | **1** |
| B7(b)(ii) | Copper loses electron(s) | **1** |
| B7(c) | Moles of acid = $0.025 \times 14.0$ **OR** 0.35 (1)<br>Moles of sulfur dioxide = 0.175 (1)<br>Volume of gas = 4.2 $dm^3$ / 4 200 $cm^3$ (1) | **3** |
| B7(d)(i) | Blue precipitate / blue solid (which does not redissolve) | **1** |
| B7(d)(ii) | Blue precipitate / blue solid (1)<br>In excess ammonia gives a dark blue solution (1) | **2** |
| B7(e) | $2CuCl \rightarrow CuCl_2 + Cu$ | **1** |

| Question | Answer | Mark |
|---|---|---|
| B8(a) | Reversible reaction | **1** |
| B8(b) | (Reaction in which) heat is released | **1** |
| B8(c) | Idea that no reactants or products can enter / leave | **1** |
| B8(d) | The colour becomes more brown / colour becomes darker (1)<br>Fewer moles on right hand side so position of equilibrium moves to the left (or reverse argument) / fewer moles on product side so position of equilibrium moves to the left (1) | **2** |
| B8(e) | The colour more brown / colour becomes darker (1)<br>Exothermic reaction so position of equilibrium moves to the left / backward reaction is endothermic so equilibrium moves to left(1) | **2** |
| B8(f)(i) | • Add a reactive metal / carbonate to the two acids at the same concentration (1)<br>AND 1 mark for any one of:<br>• Time how long it takes for the metal / carbonate to disappear (1)<br>• Time how long it takes to produce a fixed volume of gas (1)<br>• Count the number of bubbles over fixed time interval (1)<br>• Weak acid has a long**er** reaction time (or reverse argument) / weak acid produces few**er** bubbles in a given time interval (1)<br><br>**OR**<br>• Add universal indicator to the two acids at the same concentration (1)<br>AND 1 mark for either one of:<br>• Compare colour with colour chart (1)<br>• Red with strong acid AND yellow with weak acid (1)<br><br>**OR**<br>• Dip pH meter into the two acids at the same concentration (1)<br>AND 1 mark for either one of:<br>• Record pH (1)<br>• pH low**er** for strong acid / pH less for strong acid (than for weak acid) (or reverse argument) (1) | **2** |
| B8(f)(ii) | $KNO_2$ **AND** $KNO_3$ | **1** |

| Question | Answer | Mark |
|---|---|---|
| B9(a) | Fuel | **1** |
| B9(b) | Decomposing vegetation | **1** |
| B9(c) | Climate change / global warming | **1** |
| B9(d)(i) | $\frac{\text{H}}{0.040}$ $\frac{\text{C}}{0.242}$ $\frac{\text{Cl}}{0.718}$ **OR** $\frac{}{1}$ $\frac{}{12}$ $\frac{}{35.5}$<br><br>0.040 mol 0.020 mol 0.020 mol (1)<br><br>$CH_2Cl$ (1) | **2** |
| B9(d)(ii) | $C_2H_4Cl_2$ | **1** |
| B9(e)(i) | The (overall) movement of particles from high concentration to a low concentration / mixing due to (random) movement of particles | **1** |
| B9(e)(ii) | Particles are moving faster / particles have more kinetic energy | **1** |
| B9(e)(iii) | **Molecules**/**particles** have different (relative formula) masses / **molecules**/**particles** have different (relative molecular) masses (1)<br><br>Methane (molecules) move or diffuse faster / butane (molecules) move or diffuse more slowly (1) | **2** |

| Question | Answer | Mark |
|---|---|---|
| B10(a)(i) | $C_nH_{2n+1}OH$ / $C_nH_{2n+2}O$ | **1** |
| B10(a)(ii) | Any value between 154 – 164 (°C) (inclusive of these values) | **1** |
| B10(b) | (Add) yeast (1)<br>Temperature between 5 and 40 °C / no oxygen present / anaerobic (1)<br>(Fractionally) distil (to get ethanol) (1) | **3** |
| B10(c) | Butyl ethanoate (1)<br>  (1) | **2** |
| B10(d) | They get slower / they move less rapidly (when temperature decreases) / molecules slow down (when temperature decreases) / molecules have less kinetic energy (when temperature decreases) (1)<br>They / molecules get closer together (when temperature decreases) (1)<br>They / molecules arranged less randomly / less irregularly (when temperature decreases) (1) | **3** |