



**Cambridge International Examinations**  
Cambridge Ordinary Level

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**CHEMISTRY**

**5070/22**

Paper 2 Theory

**May/June 2017**

MARK SCHEME

Maximum Mark: 75

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**Published**

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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 border="1"> <thead> <tr> <th>particle</th> <th>atomic number</th> <th>number of neutrons in particle</th> <th>number of electrons in particle</th> </tr> </thead> <tbody> <tr> <td><math>^{35}\text{Cl}</math></td> <td>17</td> <td>18</td> <td>17 (1)</td> </tr> <tr> <td><math>^{37}\text{Cl}</math> (1)</td> <td>17</td> <td>20</td> <td>17</td> </tr> <tr> <td><math>^{39}\text{K}^+</math></td> <td>19</td> <td>20 (1)</td> <td>18</td> </tr> <tr> <td><math>^{79}\text{Br}^-</math></td> <td>35 (1)</td> <td>44</td> <td>36</td> </tr> <tr> <td><math>^{81}\text{Br}</math></td> <td>35</td> <td>46 (1)</td> <td>35</td> </tr> <tr> <td><math>^{85}\text{Rb}^+</math> (1)</td> <td>37</td> <td>48</td> <td>36</td> </tr> </tbody> </table>	particle	atomic number	number of neutrons in particle	number of electrons in particle	$^{35}\text{Cl}$	17	18	17 (1)	$^{37}\text{Cl}$ (1)	17	20	17	$^{39}\text{K}^+$	19	20 (1)	18	$^{79}\text{Br}^-$	35 (1)	44	36	$^{81}\text{Br}$	35	46 (1)	35	$^{85}\text{Rb}^+$ (1)	37	48	36	6
particle	atomic number	number of neutrons in particle	number of electrons in particle																											
$^{35}\text{Cl}$	17	18	17 (1)																											
$^{37}\text{Cl}$ (1)	17	20	17																											
$^{39}\text{K}^+$	19	20 (1)	18																											
$^{79}\text{Br}^-$	35 (1)	44	36																											
$^{81}\text{Br}$	35	46 (1)	35																											
$^{85}\text{Rb}^+$ (1)	37	48	36																											
A2(b)(i)	<u>Atoms</u> with same number of protons but different <u>number</u> of neutrons / <u>atoms</u> with same atomic number but different nucleon <u>number</u> / <u>atoms</u> of the same element with different <u>number</u> of neutrons	1																												
A2(b)(ii)	$^{35}\text{Cl}$ and $^{37}\text{Cl}$	1																												

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Question	Answer	Mark
A3(a)(i)	Hydrochloric acid <b>AND</b> magnesium oxide	1
A3(a)(ii)	1 mark each for any 4 of: <ul style="list-style-type: none"> <li>• Use of <b>excess</b> base (1)</li> <li>• Use hot acid / use warm acid / warm the mixture (of acid and base) (1)</li> <li>• Filter mixture (to get filtrate) (1)</li> <li>• Evaporate some of filtrate and allow to crystallise / leave in warm place to crystallise / heat to crystallisation point (1)</li> <li>• (Filter), wash with organic solvent / dry with filter paper / dry in a (drying) oven (1)</li> </ul>	4
A3(b)	$\text{Ba}^{2+}(\text{aq}) + \text{SO}_4^{2-}(\text{aq}) \rightarrow \text{BaSO}_4(\text{s})$ Correct formulae and balancing (1) Correct state symbols – dependent on correct formulae (1)	2
A3(c)(i)	Moles of acid = $0.020 \times 0.65$ <b>OR</b> 0.013 (1) 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) Oxide ion: 2.8 (1)	2
A(b)	Negative electrode: $\text{Na}^+ + \text{e}^- \rightarrow \text{Na}$ (1) Positive electrode: $2\text{O}^{2-} \rightarrow \text{O}_2 + 4\text{e}^-$ (1)	2
A(c)	Ions move / mobile ions / ions free to move	1
A(d)	$\text{Na}_2\text{O} + \text{H}_2\text{O} \rightarrow 2\text{NaOH}$	1

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Question	Answer	Mark
A5(a)	(Acidified) potassium manganate(VII) / oxygen	1
A5(b)(i)	Lithium / sodium / potassium / calcium / magnesium (1) Corresponding ethanoate <b>AND</b> hydrogen (1)	2
A5(b)(ii)	$\text{CaCO}_3 + 2\text{CH}_3\text{CO}_2\text{H} \rightarrow \text{Ca}(\text{CH}_3\text{CO}_2)_2 + \text{H}_2\text{O} + \text{CO}_2$ (2) IF: two marks not scored $\text{H}_2\text{O}$ and $\text{CO}_2$ as products = 1 mark	2
A5(c)	$  \begin{array}{c}  \text{H} \\    \\  \text{H}-\text{C}-\text{H} \\    \\  \begin{array}{ccc}  \text{H} & & \text{O} \\    & &    \\  \text{H}-\text{C}-\text{C}-\text{C}-\text{O}-\text{H} \\    &   & \\  \text{H} & \text{H} &   \end{array}  \end{array}  $	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

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Question	Answer	Mark
A6(a)	Energy / enthalpy on vertical axis <b>AND</b> progress of reaction / course of reaction on horizontal axis (1) Reactant level above product level and to the left of product <b>AND</b> reactants and products labelled (1) Enthalpy change shown by downward arrow <b>AND</b> labelled enthalpy change or $\Delta H$ (1)	<b>3</b>
A6(b)	1 mark each for any <b>two</b> of: <ul style="list-style-type: none"> <li>• Lower activation energy (1)</li> <li>• More particles have energy equal to / greater than the activation energy (1)</li> <li>• Different pathway / different mechanism / via an enzyme complex (1)</li> <li>• more successful collisions (between groups on enzyme and substrates) / number of effective collisions increase (with specific groups on enzyme surface) (1)</li> </ul>	<b>2</b>
A6(c)	Idea that combustion <b>AND</b> respiration increase levels of carbon dioxide / carbon in the atmosphere (1) Idea that photosynthesis reduces levels of carbon dioxide / carbon in the atmosphere (1) Idea that these processes balance each other (1)	<b>3</b>

Question	Answer	Mark
B7(a)	Blue solution / bubbles	<b>1</b>
B7(b)(i)	Copper(II) sulfate	<b>1</b>
B7(b)(ii)	Copper loses electron(s)	<b>1</b>
B7(c)	Moles of acid = $0.025 \times 14.0$ <b>OR</b> 0.35 (1) Moles of sulfur dioxide = 0.175 (1) Volume of gas = $4.2 \text{ dm}^3 / 4\,200 \text{ cm}^3$ (1)	<b>3</b>
B7(d)(i)	Blue precipitate / blue solid (which does not redissolve)	<b>1</b>
B7(d)(ii)	Blue precipitate / blue solid (1) In excess ammonia gives a dark blue solution (1)	<b>2</b>
B7(e)	$2\text{CuCl} \rightarrow \text{CuCl}_2 + \text{Cu}$	<b>1</b>

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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) 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) Exothermic reaction so position of equilibrium moves to the left / backward reaction is endothermic so equilibrium moves to left(1)	2
B8(f)(i)	<ul style="list-style-type: none"> <li>• Add a reactive metal / carbonate to the two acids at the same concentration (1)</li> </ul> AND 1 mark for any one of: <ul style="list-style-type: none"> <li>• Time how long it takes for the metal / carbonate to disappear (1)</li> <li>• Time how long it takes to produce a fixed volume of gas (1)</li> <li>• Count the number of bubbles over fixed time interval (1)</li> <li>• Weak acid has a longer reaction time (or reverse argument) / weak acid produces fewer bubbles in a given time interval (1)</li> </ul> <p><b>OR</b></p> <ul style="list-style-type: none"> <li>• Add universal indicator to the two acids at the same concentration (1)</li> </ul> AND 1 mark for either one of: <ul style="list-style-type: none"> <li>• Compare colour with colour chart (1)</li> <li>• Red with strong acid AND yellow with weak acid (1)</li> </ul> <p><b>OR</b></p> <ul style="list-style-type: none"> <li>• Dip pH meter into the two acids at the same concentration (1)</li> </ul> AND 1 mark for either one of: <ul style="list-style-type: none"> <li>• Record pH (1)</li> <li>• pH lower for strong acid / pH less for strong acid (than for weak acid) (or reverse argument) (1)</li> </ul>	2
B8(f)(ii)	KNO <sub>2</sub> AND KNO <sub>3</sub>	1

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Question	Answer	Mark
B9(a)	Fuel	1
B9(b)	Decomposing vegetation	1
B9(c)	Climate change / global warming	1
B9(d)(i)	$\begin{array}{ccc} \text{H} & \text{C} & \text{Cl} \\ \frac{0.040}{1} & \frac{0.242}{12} & \frac{0.718}{35.5} \end{array} \quad \text{OR}$ <p>0.040 mol 0.020 mol 0.020 mol (1)</p> <p>CH<sub>2</sub>Cl (1)</p>	2
B9(d)(ii)	C <sub>2</sub> H <sub>4</sub> Cl <sub>2</sub>	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)	<p><b>Molecules/particles</b> have different (relative formula) masses / <b>molecules/particles</b> have different (relative molecular) masses (1)</p> <p>Methane (molecules) move or diffuse faster / butane (molecules) move or diffuse more slowly (1)</p>	2

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Question	Answer	Mark
B10(a)(i)	$C_nH_{2n+1}OH / C_nH_{2n+2}O$	<b>1</b>
B10(a)(ii)	Any value between 154 – 164 (°C) (inclusive of these values)	<b>1</b>
B10(b)	(Add) yeast (1) Temperature between 5 and 40 °C / no oxygen present / anaerobic (1) (Fractionally) distil (to get ethanol) (1)	<b>3</b>
B10(c)	Butyl ethanoate (1)  $  \begin{array}{ccccccccccc}  & H & O & & H & H & H & H & & & \\  &   &    & &   &   &   &   & & & \\  H & - C & - C & - O & - C & - C & - C & - C & - H & (1) & \\  &   & & &   &   &   &   & & & \\  & H & & & H & H & H & H & & &   \end{array}  $	<b>2</b>
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) They / molecules get closer together (when temperature decreases) (1) They / molecules arranged less randomly / less irregularly (when temperature decreases) (1)	<b>3</b>