



CHEMISTRY

5070/22

Paper 2 Theory

May/June 2017

MARK SCHEME

Maximum Mark: 75

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>^{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>$^{39}\text{K}^+$</td> <td>19</td> <td>20 (1)</td> <td>18</td> </tr> <tr> <td>$^{79}\text{Br}^-$</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>$^{85}\text{Rb}^+$ (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}Cl	17	18	17 (1)	^{37}Cl (1)	17	20	17	$^{39}\text{K}^+$	19	20 (1)	18	$^{79}\text{Br}^-$	35 (1)	44	36	^{81}Br	35	46 (1)	35	$^{85}\text{Rb}^+$ (1)	37	48	36	6
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$^{85}\text{Rb}^+$ (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}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: <ul style="list-style-type: none"> • Use of excess base (1) • Use hot acid / use warm acid / warm the mixture (of acid and base) (1) • Filter mixture (to get filtrate) (1) • Evaporate some of filtrate and allow to crystallise / leave in warm place to crystallise / heat to crystallisation point (1) • (Filter), wash with organic solvent / dry with filter paper / dry in a (drying) oven (1) 	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 = 0.020×0.65 OR 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

Question	Answer	Mark
A5(a)	(Acidified) potassium manganate(VII) / oxygen	1
A5(b)(i)	Lithium / sodium / potassium / calcium / magnesium (1) Corresponding ethanoate AND 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 H_2O and CO_2 as products = 1 mark	2
A5(c)	<pre> H H-C-H H O H-C-C-C-O-H H H </pre>	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) Reactant level above product level and to the left of product AND reactants and products labelled (1) Enthalpy change shown by downward arrow AND labelled enthalpy change or ΔH (1)	3
A6(b)	1 mark each for any two of: <ul style="list-style-type: none"> • Lower activation energy (1) • More particles have energy equal to / greater than the activation energy (1) • Different pathway / different mechanism / via an enzyme complex (1) • 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) Idea that photosynthesis reduces levels of carbon dioxide / carbon in the atmosphere (1) 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 = 0.025×14.0 OR 0.35 (1) Moles of sulfur dioxide = 0.175 (1) Volume of gas = $4.2 \text{ dm}^3 / 4\,200 \text{ cm}^3$ (1)	3
B7(d)(i)	Blue precipitate / blue solid (which does not redissolve)	1
B7(d)(ii)	Blue precipitate / blue solid (1) In excess ammonia gives a dark blue solution (1)	2
B7(e)	$2\text{CuCl} \rightarrow \text{CuCl}_2 + \text{Cu}$	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) 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"> • Add a reactive metal / carbonate to the two acids at the same concentration (1) AND 1 mark for any one of: <ul style="list-style-type: none"> • Time how long it takes for the metal / carbonate to disappear (1) • Time how long it takes to produce a fixed volume of gas (1) • Count the number of bubbles over fixed time interval (1) • Weak acid has a longer reaction time (or reverse argument) / weak acid produces fewer bubbles in a given time interval (1) <p>OR</p> <ul style="list-style-type: none"> • Add universal indicator to the two acids at the same concentration (1) AND 1 mark for either one of: <ul style="list-style-type: none"> • Compare colour with colour chart (1) • Red with strong acid AND yellow with weak acid (1) <p>OR</p> <ul style="list-style-type: none"> • Dip pH meter into the two acids at the same concentration (1) AND 1 mark for either one of: <ul style="list-style-type: none"> • Record pH (1) • pH lower 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)	$\begin{array}{ccc} \text{H} & \text{C} & \text{Cl} \\ \hline 0.040 & 0.242 & 0.718 \\ 1 & 12 & 35.5 \end{array} \quad \text{OR}$ <p>0.040 mol 0.020 mol 0.020 mol (1)</p> <p>CH₂Cl (1)</p>	2
B9(d)(ii)	C ₂ H ₄ Cl 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)	<p>Molecules/particles have different (relative formula) masses / molecules/particles have different (relative molecular) masses (1)</p> <p>Methane (molecules) move or diffuse faster / butane (molecules) move or diffuse more slowly (1)</p>	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) Temperature between 5 and 40 °C / no oxygen present / anaerobic (1) (Fractionally) distil (to get ethanol) (1)	3
B10(c)	Butyl ethanoate (1) $ \begin{array}{cccccccc} & H & O & & H & H & H & H \\ & & & & & & & \\ H & - C & - C & - O & - C & - C & - C & - C & - H \\ & & & & & & & \\ & H & & & H & H & H & H \end{array} $ (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) They / molecules get closer together (when temperature decreases) (1) They / molecules arranged less randomly / less irregularly (when temperature decreases) (1)	3