Group 1 & 2

Mark Scheme 1

Level	International A Level
Subject	Chemistry
Exam Board	Edexcel
Topic	Application of Core Principles of Chemistry
Sub Topic	Group 1 & 2
Booklet	Mark Scheme 1

Time Allowed: **59 minutes**

Score: **/49**

Percentage: **/100**

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

Question Number	Correct Answer	Mark
1	B	**(1)**
	Incorrect answers A – solubility of sulfates does not decrease C – solubility of hydroxides does not increase and solubility of hydroxides does not decrease D – solubility of hydroxides does not increase	

Question Number	Correct Answer	Mark
2	B	**1**

Question Number	Correct Answer	Mark
3	B	**1**

Question Number	Correct Answer	Mark
4	B	**1**

Question Number	Correct Answer	Reject	Mark
5	C		1

Question Number	Correct Answer	Reject	Mark
6	D		1

Question Number	Correct Answer	Reject	Mark
7	B		1

Question Number	Correct Answer	Reject	Mark
8	A		1

Question Number	Correct Answer	Reject	Mark
9	C		1

Question Number	Correct Answer	Reject	Mark
10	D		**1**

Question Number	Correct Answer	Reject	Mark
11	C		**1**

Question Number	Correct Answer	Reject	Mark
12	A		**1**

Question Number	Correct Answer	Reject	Mark
13	C		**1**

Question Number	Acceptable Answers	Reject	Mark
14(a)(i)	Green (flame) ALLOW any shade of green eg pale green, apple green	Any other colour in combination with green eg blue-green	**(1)**

Question Number	Acceptable Answers	Reject	Mark
14(a)(ii)	Read the whole answer before awarding marks. If no mention of electrons only M3 may be awarded **First mark** Electrons excited/promoted to a higher energy level/shell (by thermal energy /heat from (Bunsen) flame) **(1)** IGNORE atom / ion **Second mark** (Promoted) electrons fall /drop /relax / return to a lower energy level /(sub)shell/ orbital OR Electrons return to ground state ALLOW Electrons drop back down / de-excited **(1)** IGNORE atom / ion **Third mark** Emitting (energy in the form of) radiation/ light /photons (in the visible region) **(1)** ALLOW release / give out for emit IGNORE colour / wavelength / frequency	Just 'electrons excited / promoted' Just 'energy lost' Just 'energy emitted'	**(3)**

Question Number	Acceptable Answers	Reject	Mark
14(b)(i)	$2NaNO_3 \rightarrow 2NaNO_2 + O_2$ OR $NaNO_3 \rightarrow NaNO_2 + ½O_2$ OR multiples IGNORE state symbols, even if incorrect		**(1)**

Question Number	Acceptable Answers	Reject	Mark
14(b)(ii)	$2Mg(NO_3)_2 \rightarrow 2MgO + 4NO_2 + O_2$ OR $Mg(NO_3)_2 \rightarrow MgO + 2NO_2 + ½O_2$ OR multiples IGNORE State symbols, even if incorrect Water of crystallisation NOTE If no marks awarded for (b)(i) or (b)(ii), allow 1 mark for all correct products in unbalanced equations in (b)(i) and (b)(ii)		**(1)**

Question Number	Acceptable Answers	Reject	Mark
14(c)	**First mark – charge** Magnesium ion has a greater charge than sodium ion OR Magnesium is Mg^{2+} and sodium is Na^{+} ALLOW magnesium ion has a higher charge density ALLOW Mg have a charge of +2 and Na has a charge of +1 ALLOW mention of atoms **(1)** **Second mark – size** Magnesium **ion** is smaller than sodium ion OR Sodium **ion** is larger than magnesium ion ALLOW magnesium is smaller than sodium, or reverse argument, if ion is stated for first mark **(1)** IGNORE atomic radius **Third mark – comparison of polarising power** Magnesium / Mg^{2+} / cation / smaller ion causes more polarisation / distortion OR Sodium / Na^{+} / cation / larger ion causes less polarisation / distortion **(1)** **Fourth mark – what is polarised** C-O bonds / C=O bonds ALLOW (Electron cloud in) carbonate (ion) / CO_3^{2-} / anion / negative ion (and therefore magnesium carbonate decomposes more readily) **(1)** IGNORE magnesium carbonate is more polarised (than sodium carbonate)	Mg / Mg^{2+} is distorted N-O bonds / N=O bonds / nitrate ion / NO_3^{-} Bond between cation and anion is more easily broken	**(4)**

Question Number	Acceptable Answers	Reject	Mark
14(d)(i)	Correct answer with no working or an alternative method scores (3) marks mol HCl used = $\frac{16.65 \times 0.105}{1000}$ **(1)** $= 1.74825 \times 10^{-3}$ mol Na_2CO_3 in 25 cm^3 = $\frac{1.74825 \times 10^{-3}}{2}$ $= 8.74125 \times 10^{-4}$ TE on mol HCl **(1)** mol Na_2CO_3 in 250 cm^3 $= 8.74125 \times 10^{-4} \times 10$ $= 8.74125 \times 10^{-3}$ TE on mol Na_2CO_3 in 25 cm^3 **(1)** IGNORE SF except 1 SF	Incorrect rounding or use of 1SF once only in (d)(i) and (d)(ii)	**(3)**

Question Number	Acceptable Answers	Reject	Mark
14(d)(ii)	**Molar mass** M_r of $Na_2CO_3.xH_2O$ = $\frac{2.50}{8.74125 \times 10^{-3}}$ $= 286(.0)$ **(1)** **Value of x** x = $\frac{286 - 106}{18}$ = 10 **(1)** Both marks TE on 21(d)(i) but do not award M2 if M_r of **hydrate** < 106 **Alternative method** **Value of x** Mass $Na_2CO_3 = 8.74125 \times 10^{-3} \times 106 = 0.92657$ (g) Mass $H_2O = 2.5 - 0.92657 = 1.57343$ (g) Moles $H_2O = 1.57343/18 = 0.087413$ Ratio $Na_2CO_3 : H_2O = 1 : 10$ **(1)** **Molar mass** M_r of $Na_2CO_3.10H_2O = 286$ TE on value of x **(1)**		**(2)**

Question Number	Acceptable Answers	Reject	Mark
14(d)(iii)	Two matching pairs in either order. The effect on titration volumes is **conditional** on the error. Answers can be written on either set of lines **Error 1** Not washing the weighing bottle (with distilled water) OR Not re-weighing the weighing bottle ALLOW Not adding washings to volumetric flask OR Any indication that any solid left in the bottle needs to be accounted for OR Some solid is spilled when it is tipped into the volumetric flask **(1)** IGNORE some solid is undissolved / any reference to uncertainties **Effect on titration volumes 1** The titration volume is less because lower / decreased concentration (of sodium carbonate) **(1)** **Error 2** Not shaking / inverting / mixing the solution in the volumetric flask **(1)** **Effect on titration volumes 2** Titres inconsistent / varied because non-homogeneous solution **(1)**		**(4)**

(Total for Question 14 = 19 marks)

Question Number	Acceptable Answers	Reject	Mark
15(a)(i)	(n=0.05 x 0.00450=) 2.25 x 10^{-4} / 0.000225 (mol) IGNORE SF except 1SF		1

Question Number	Acceptable Answers	Reject	Mark
15(a)(ii)	(n=2.25 x 10^{-4} x 2=) 4.50 x 10^{-4} / 0.000450 (mol) TE ans to (a)(i) x 2 IGNORE SF except 1SF		1

Question Number	Acceptable Answers	Reject	Mark
15(a)(iii)	(c=4.50 x 10^{-4} ÷ 0.025=) 1.8 x 10^{-2} / 0.018 / 1.80 x 10^{-2} /0.0180 (mol dm^{-3}) TE ans to (a)(ii) ÷0.025 IGNORE SF except 1SF		1

Question Number	Acceptable Answers	Reject	Mark
15(a)(iv)	Start at final answer (the difference) if correct or correct TE from (iii) then give 3 marks with or without correct working Ignore SF except 1SF for the "difference" only but do not penalise trailing zeros **NOTE** Negative value for "difference" does not get MP3 but can score MP1 and MP2 only **If answer is incorrect** then look at following working **MP1** Initial KOH concentration n=226.8 ÷ 56.1= (1) 4.04278/4.04 (mol) ALLOW use of 56 **MP2** [KOH]= 4.04278 ÷ 45 = (1) 8.9840×10^{-2} / 0.089840 (mol dm^{-3}) NOTE 56 gives 0.09 A TE is allowed from incorrect number of mols **MP3** Difference $(8.9840 \times 10^{-2} - 1.80 \times 10^{-2} =)$ 7.1840×10^{-2} / 0.071840 (mol dm^{-3}) NOTE 56 gives 0.072 (1) **Transferred errors** 8.98×10^{-2} – **ans to (a)(iii)** OR Their initial concentration of KOH – ans to (a)(iii) COMMENT A difference of 0.071 means there has been a rounding error and so will score 2 marks only if rounding errors have not already been penalised.	0.07	3

Question Number	Acceptable Answers	Reject	Mark
15(a)(v)	Correct final answer (181/182) to 3SF with or without working scores (2) **Answer to (iv)** x 45 OR x 56.1 (1) n=7.18 x 10^{-2}x 45= (3.231) (mol) m=3.231 x 56.1 = (181.359 / 181.4) OR 181.2591 / 181.3 = 181 (g) NOTE ALLOW USE OF 56 (1) **Alternative method** **Answer to (ii)** x $\frac{45000}{25}$ OR x 56/56.1 (1) Amount = 0.81 (mol) Mass of KOH left 0.81 x 56.1/56 = 45.441/45.36 (g) Mass used = 226.8 – 45.441/45.36 = 181 (g) (1)		2

Some TE values:

Part	Answer	Mark	Answer	Mark
(i)	$\frac{25 \times 0.05}{1000}$ = 1.25 x 10^{-3}	0	$\frac{25 \times 4.5}{1000}$ = 0.1125	0
(ii)	2.5 x 10^{-3}	1	0.225	1
(iii)	0.1	1	9	1
(iv)	0.089 – 0.1 = -0.0102	2	0.089 - 9 = -8.91	2
(v)	0.459 (mol) and 25.7 (g)	2	400.95 (mol) and 22 500 (g)	2

Question Number	Acceptable Answers	Reject	Mark
15(b)(i)	(From) (pale/bright) pink/red (1) (To) colourless (1) ALLOW one mark for 'colourless to pink/red (1) Second mark dependant on shade of pink/red/purple for first colour	purple …clear	2

Question Number	Acceptable Answers	Reject	Mark
15(b)(ii)	**d / brown / colour** (from the hair/skin likely to have) leached out/dissolved/ solution formed ALLOW **Red / brown / colour** from the hair/skin makes the (colour) change/end point difficult to judge/see		1

Question Number	Acceptable Answers	Reject	Mark
15(b)(iii)	No Only a few drops of indicator used OR Adding to an aqueous solution OR Ethanol mixes with water (in all proportions) ALLOW Ethanol is in solution IGNORE Any other reasons	Yes…	1

Question Number	Acceptable Answers	Reject	Mark
15(c)(i)	(Titre error) ($\frac{0.05 \times 2}{4.50}$ x 100=) ±2.2(2) (%) (1) (Sample error) ($\frac{0.06}{25}$ x 100=) ±0.24 (%) (1)		2

Question Number	Acceptable Answers	Reject	Mark
15(c)(ii)	**Mark each point independently** **Any two from:** Reduce the concentration of the sulfuric acid (1) Use a larger (initial) sample/R/KOH volume (1) Use HCl(aq) (of same concentration as sulfuric acid which would have a larger titre) (1) Use greater (initial) concentration/mass of KOH (1) Use less skin (1) IGNORE (Just) use larger titre Repeat the titration Just changing the concentration	Use more skin	2

Question Number	Acceptable Answers	Reject	Mark
15(c)(iii)	When it is concordant/the same OR Within ±0.1 (cm^3) of the (mean of) other titres ALLOW Within ±0.2 (cm^3) of the other titres (**comment** this is as per the User guide) IGNORE Close/similar/almost the same as other titres		1

TOTAL FOR QUESTION 15 = 17 MARKS