

## Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
<b>05.1</b>	add excess copper carbonate (to dilute hydrochloric acid)	accept alternatives to excess, such as 'until no more reacts'	1	AO1/2 4.4.2.3
	filter (to remove excess copper carbonate)	reject heat until dry	1	
	heat filtrate to evaporate some water <b>or</b> heat to point of crystallisation	accept leave to evaporate or leave in evaporating basin	1	
	leave to cool (so crystals form)	until crystals form  must be in correct order to gain <b>4</b> marks	1	
<b>05.2</b>	$M_r \text{ CuCl}_2 = 134.5$	correct answer scores <b>4</b> marks      accept 10.1 with no working shown for <b>4</b> marks	1	AO2/1
	moles copper chloride = (mass/ $M_r$ = $11/134.5$ ) = 0.0817843866		1	AO2/1
	$M_r \text{ CuCO}_3 = 123.5$		1	AO2/1
	Mass $\text{CuCO}_3$ (=moles $\times M_2$ = $0.08178 \times 123.5$ ) = 10.1(00)		1	AO2/1 4.3.2.2
<b>05.3</b>	$\frac{79.1}{100} \times 11.0$  <b>or</b> $11.0 \times 0.791$	accept 8.70(g) with no working shown for <b>2</b> marks	1	AO2/1 4.3.3.1
	8.70 (g)		1	

Question 5 continues on the next page

**Question 5 continued**

Question	Answers	Extra information	Mark	AO / Spec. Ref.
<b>05.4</b>	Total mass of reactants = 152.5		1	
	<u>134.5</u>	allow ecf from step 1	1	
	152.5			
	88.20 (%)	allow 88.20 with no working shown for <b>3</b> marks	1	AO2/2 4.3.3.2
<b>05.5</b>	atom economy using carbonate lower because an additional product is made <b>or</b> carbon dioxide is made as well	allow ecf	1	AO3/2b 4.3.3.2
<b>Total</b>			<b>14</b>	

**Question 8**

Question	Answers	Extra information	Mark	AO / Spec. Ref.
<b>08.1</b>	(sulfuric acid is) completely/fully ionised		1	AO1/1 4.4.2.6
	In aqueous solution <b>or</b> when dissolved in water		1	
<b>08.2</b>	$\text{H}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l})$	allow multiples 1 mark for equation 1 mark for state symbols	2	AO1/1 4.4.2.4
<b>08.3</b>	adds indicator, eg phenolphthalein/methyl orange/litmus added to the sodium hydroxide (in the conical flask)	do <b>not</b> accept universal indicator	1	AO1/2 4.3.4 4.4.2.5
	(adds the acid from a) burette		1	
	with swirling <b>or</b> dropwise towards the end point <b>or</b> until the indicator just changes colour		1	
	until the indicator changes from pink to colourless (for phenolphthalein) or yellow to red (for methyl orange) or blue to red (for litmus)		1	
<b>08.4</b>	titrations 3, 4 and 5 <b>or</b> $\frac{27.05 + 27.15 + 27.15}{3}$		1	AO2/2 4.3.4 4.4.2.5
	27.12 cm <sup>3</sup>		1	
		accept 27.12 with no working shown for <b>2</b> marks  allow 27.1166 with no working shown for <b>2</b> marks		

**Question 8 continues on the next page**

## Question 8 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
<b>08.5</b>	Moles $\text{H}_2\text{SO}_4$ = conc $\times$ vol = 0.00271	allow ecf from 8.4	1	AO2/2
	Ratio $\text{H}_2\text{SO}_4$ :NaOH is 1:2 <b>or</b> Moles NaOH = Moles $\text{H}_2\text{SO}_4 \times 2$ = 0.00542		1	AO2/2
	Concentration NaOH = mol/vol = 0.00542/0.025 = 0.2168		1	AO2/2
	0.217 (mol/dm <sup>3</sup> )	accept 0.217 with no working for <b>4</b> marks  accept 0.2168 with no working for <b>3</b> marks	1	AO2/2  4.3.4 4.4.2.5
<b>08.6</b>	$\frac{20}{1000} \times 0.18$ = no of moles  <b>or</b> $0.15 \times 40$ g		1	AO2/2 4.3.4 4.4.2.5
	0.144 (g)	accept 0.144g with no working for <b>2</b> marks	1	
<b>Total</b>			<b>16</b>	

Question number	Answer	Additional guidance	Mark
<b>10(a)</b>	Formula mass ammonium chloride $= 14.0 + 4.00 + 35.5 = 53.5$  moles of ammonium chloride $= \frac{10.0}{53.5} = 0.187 \text{ (1)}$  volume ammonia $= 0.187 \times 24$ $= 4.49 \text{ dm}^3 \text{ (1)}$ or <ul style="list-style-type: none"> <li><math>2 \times 53.5 = 107 \text{ g}</math> ammonium chloride produces <math>2 \times 24 = 48 \text{ dm}^3</math> ammonia (1)</li> <li>10.0 g ammonium chloride produces  <math>\frac{10.0}{2 \times 53.5} \times 2 \times 24 = 4.49 \text{ dm}^3</math>                ammonia (1)</li> </ul>	Award full marks for correct numerical answer without working.	<b>(2)</b>

Question number	Answer	Additional guidance	Mark
<b>10(b)(i)</b>	$25 \div 1000 \times 0.1 = 0.0025 \text{ (1)}$  $35 \div 1000 \times 0.075 = 0.002625 \text{ (1)}$  The acid is in excess (1)	Third mark only awarded as conclusion from calculated data.	<b>(3)</b>

Question number	Answer	Mark
<b>10(b)(ii)</b>	$\frac{36.20 + 36.30}{2} = 36.25 \text{ (1)}$	<b>(1)</b>

Question number	Answer	Mark
<b>10(b)(iii)</b>	D	<b>(1)</b>

Question number	Answer	Additional guidance	Mark
<b>10(c)</b>	<p>mol of acid = <math>24.80 \div 1000 \times 0.200</math> (= 0.004 96 mol) (1)</p> <p>mol NaOH = <math>2 \times 0.004\ 96</math> (= 0.009 92) (1)</p> <p>conc. of NaOH = <math>0.009\ 92 \div 25.0 \times 1000</math> (1)</p> <p>= 0.3968/0.397 (mol dm<sup>-3</sup>) (1)</p> <p>or</p> <p><math>(25.00 \times \text{conc NaOH}) \div 2 = 24.80 \times 0.200</math> (2)</p> <p>conc NaOH = <math>2 \times 24.80 \times 0.200 \div 25.00</math> (1)</p> <p>= 0.3968/0.397 (mol dm<sup>-3</sup>) (1)</p>	<p>Award full marks for correct numerical answer without working.</p> <p>Allow max 3 marks if missing '2 ×' in step 2.</p>	<b>(4)</b>

19	(a)	<p>Mean titre = 17.1 (1)</p> <p>Because titration 1 is a rough estimate / titration 1 is an outlier / titrations 2 and 3 are identical (1)</p>	2	<p>3.1b</p> <p>3.2b</p>	<p><b>IGNORE</b> anything in the titration table</p>
	(b)	<p>Moles of acid = 0.00171 (1)</p> <p>Concentration of KOH = 0.0684 (1)</p>	2	2.1	<p><b>ALLOW ECF</b> from incorrect titre / <math>0.100 \times \text{titre} \times 10^{-3}</math></p> <p><b>ALLOW ECF</b> from incorrect moles providing answer is to 3 sig figs / moles+volume</p>
	(c)	<p><math>M_r</math> of KOH = 56.1 (1)</p> <p>Concentration of KOH = 3.84 (1)</p>	2	2.1	<p><b>ALLOW</b> correct answer without working</p> <p><b>ALLOW</b> 3.837</p>