

**CHEMISTRY****9701/52**

Paper 5 Planning, Analysis and Evaluation

**October/November 2017**

MARK SCHEME

Maximum Mark: 30

**Published**

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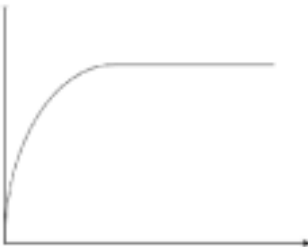
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Question	Answer	Marks
1(a)(i)	$\text{CuCO}_3$ and $\text{Cu(OH)}_2$ both react (with $\text{HCl}$ ) or both form copper(II) chloride	1
1(a)(ii)	(Transfer) $12.5(0) \text{ cm}^3$ of $(10.0 \text{ mol dm}^{-3}) \text{ HCl}$ using a (graduated) pipette or a burette	1
	add to a $250 \text{ cm}^3$ volumetric flask <b>AND</b> make to mark with distilled water	1
1(a)(iii)	Measure a volume of gas from the carbonate reaction <b>or</b> measure the (loss of) mass from the carbonate reaction	1
1(a)(iv)	Suitable apparatus for production of $\text{CO}_2$	1
	Suitable means of measuring $\text{CO}_2$ evolved	1
1(a)(v)	Correct labels on axes y-axis: volume (of gas) or mass loss or mass of 'limewater' <b>and</b> x-axis: time or t	1
	<p>curved line (from origin) to reach a plateau, e.g.</p> 	1

Question	Answer	Marks
1(a)(vi)	<p>Any sensible attempt seen to make the experiment accurate</p> <p>If mass loss Reduce risk of mass loss through spraying Insert cotton wool plug</p> <p>If gas collection Any method to reduce risk of gas loss Check apparatus is sealed Insert bung quickly</p> <p>Any attempt to measure temperature Check apparatus is at room temperature</p> <p>Apparatus accuracy Use an accurate or 2dp (or more) balance / gas syringe / measuring cylinder</p>	1
1(a)(vii)	<p>mol of <math>\text{CuCO}_3 = 0.5 \div 123.5 = 4.05 \times 10^{-3} \text{ mol}</math></p>	1
	<p>moles of <math>\text{HCl} = 2 \times 4.05 \times 10^{-3} = 8.10 \times 10^{-3} \text{ mol}</math> <b>and</b> volume of <math>\text{HCl} = 8.10 \times 10^{-3} \div 0.500 = 0.0162 \text{ dm}^3</math> <math>= 16.2 \text{ cm}^3</math></p>	1

Question	Answer	Marks
1(b)	<p>Any suitable precaution relating to stated hazard of given chemical</p> <p>For HCl Precaution (lab) gloves</p> <p>Explanation (10 mol dm<sup>-3</sup>) HCl is corrosive</p> <p>For CuCO<sub>3</sub> Precaution (lab) gloves / wash hands (after use) / face or mouth mask</p> <p>Explanation Harmful if swallowed</p>	1
1(c)(i)	$\text{moles of H}_2\text{SO}_4 = 0.40 \times \frac{24.15}{1000} = 9.66 \times 10^{-3} \text{ mol}$	1
	$\text{mass of Cu}_3(\text{CO}_3)_2(\text{OH})_2 = 344.5 \times 9.66 \times 10^{-3} \div 3 = 1.11 \text{ g}$	1
	$\% \text{ by mass} = \frac{1.11}{1.50} \times 100\% = 74.0\%$	1

Question	Answer	Marks
1(c)(ii)	<p>Problem 1 titres are not concordant / are too far apart / are 0.5(0) <math>\text{cm}^3</math> apart / difference is too large</p> <p>Improvement Repeat until (two) concordant titres have been achieved / two readings within 0.1(0) <math>\text{cm}^3</math></p> <p>Problem 2 colour change (of indicator) will be masked</p> <p>Improvement 2 Use an alternative indicator / named indicator</p> <p>[1] for each problem, [1] for an improvement</p>	<b>3</b>

Question	Answer				Marks																																								
2(a)(i)	<table border="1" data-bbox="349 220 994 767"> <thead> <tr> <th data-bbox="349 220 539 312">Difference in conc. <math>D</math></th> <th data-bbox="546 220 692 312"><math>\frac{D}{m}</math></th> <th data-bbox="698 220 844 312"><math>\log\left(\frac{D}{m}\right)</math></th> <th data-bbox="851 220 994 312"><math>\log[X]</math></th> </tr> </thead> <tbody> <tr><td data-bbox="349 317 539 360">24.04</td><td data-bbox="546 317 692 360">120.20</td><td data-bbox="698 317 844 360">2.08</td><td data-bbox="851 317 994 360">-0.02</td></tr> <tr><td data-bbox="349 365 539 408">24.31</td><td data-bbox="546 365 692 408">97.24</td><td data-bbox="698 365 844 408">1.99</td><td data-bbox="851 365 994 408">-0.16</td></tr> <tr><td data-bbox="349 413 539 456">24.40</td><td data-bbox="546 413 692 456">81.33</td><td data-bbox="698 413 844 456">1.91</td><td data-bbox="851 413 994 456">-0.22</td></tr> <tr><td data-bbox="349 461 539 504">24.59</td><td data-bbox="546 461 692 504">70.26</td><td data-bbox="698 461 844 504">1.85</td><td data-bbox="851 461 994 504">-0.39</td></tr> <tr><td data-bbox="349 509 539 552">24.67</td><td data-bbox="546 509 692 552">61.68</td><td data-bbox="698 509 844 552">1.79</td><td data-bbox="851 509 994 552">-0.48</td></tr> <tr><td data-bbox="349 557 539 600">24.73</td><td data-bbox="546 557 692 600">54.96</td><td data-bbox="698 557 844 600">1.74</td><td data-bbox="851 557 994 600">-0.57</td></tr> <tr><td data-bbox="349 604 539 647">24.77</td><td data-bbox="546 604 692 647">49.54</td><td data-bbox="698 604 844 647">1.69</td><td data-bbox="851 604 994 647">-0.64</td></tr> <tr><td data-bbox="349 652 539 695">24.80</td><td data-bbox="546 652 692 695">45.09</td><td data-bbox="698 652 844 695">1.65</td><td data-bbox="851 652 994 695">-0.70</td></tr> <tr><td data-bbox="349 700 539 743">24.83</td><td data-bbox="546 700 692 743">41.38</td><td data-bbox="698 700 844 743">1.62</td><td data-bbox="851 700 994 743">-0.77</td></tr> </tbody> </table> <p data-bbox="349 804 629 903"><math>D</math> data correct [1] log[X] data correct [1] All data to 2 dp [1]</p>				Difference in conc. $D$	$\frac{D}{m}$	$\log\left(\frac{D}{m}\right)$	$\log[X]$	24.04	120.20	2.08	-0.02	24.31	97.24	1.99	-0.16	24.40	81.33	1.91	-0.22	24.59	70.26	1.85	-0.39	24.67	61.68	1.79	-0.48	24.73	54.96	1.74	-0.57	24.77	49.54	1.69	-0.64	24.80	45.09	1.65	-0.70	24.83	41.38	1.62	-0.77	3
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2(a)(ii)	greater adsorption				1																																								
	greater surface area available				1																																								
2(b)	all nine points plotted correctly				1																																								
	best-fit straight line drawn				1																																								
2(c)	Correct point (at -0.22, 1.91) identified				1																																								
	Statement explaining lack of adsorption, e.g. not enough stirring, mass of activated charcoal too low, surface area not high enough / too low / coagulation of charcoal / bulkier particles used not left long enough				1																																								

<b>Question</b>	<b>Answer</b>	<b>Marks</b>
2(d)(i)	co-ordinates read and recorded correctly	<b>1</b>
	gradient determined <b>and</b> same value for $b$	<b>1</b>
2(d)(ii)	intercept on $y$ -axis read and recorded correctly	<b>1</b>