
CHEMISTRY

9701/52

Paper 5 Planning, Analysis and Evaluation

October/November 2017

MARK SCHEME

Maximum Mark: 30


Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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Question	Answer	Marks
1(a)(i)	CuCO_3 and Cu(OH)_2 both react (with 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 cm^3 volumetric flask AND make to mark with distilled water	1
1(a)(iii)	Measure a volume of gas from the carbonate reaction or measure the (loss of) mass from the carbonate reaction	1
1(a)(iv)	Suitable apparatus for production of CO_2	1
	Suitable means of measuring CO_2 evolved	1
1(a)(v)	Correct labels on axes y-axis: volume (of gas) or mass loss or mass of 'limewater' and 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 $\text{CuCO}_3 = 0.5 \div 123.5 = 4.05 \times 10^{-3} \text{ mol}$</p>	1
	<p>moles of $\text{HCl} = 2 \times 4.05 \times 10^{-3} = 8.10 \times 10^{-3} \text{ mol}$ and volume of $\text{HCl} = 8.10 \times 10^{-3} \div 0.500 = 0.0162 \text{ dm}^3$ $= 16.2 \text{ cm}^3$</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⁻³) HCl is corrosive</p> <p>For CuCO₃ 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) cm³ apart / difference is too large</p> <p>Improvement Repeat until (two) concordant titres have been achieved / two readings within 0.1(0) cm³</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>	3

Question	Answer				Marks																																								
2(a)(i)	<table border="1" data-bbox="349 217 994 767"> <thead> <tr> <th data-bbox="349 217 539 309">Difference in conc. D</th> <th data-bbox="546 217 692 309">$\frac{D}{m}$</th> <th data-bbox="698 217 844 309">$\log\left(\frac{D}{m}\right)$</th> <th data-bbox="851 217 994 309">$\log[X]$</th> </tr> </thead> <tbody> <tr><td data-bbox="349 314 539 360">24.04</td><td data-bbox="546 314 692 360">120.20</td><td data-bbox="698 314 844 360">2.08</td><td data-bbox="851 314 994 360">-0.02</td></tr> <tr><td data-bbox="349 365 539 411">24.31</td><td data-bbox="546 365 692 411">97.24</td><td data-bbox="698 365 844 411">1.99</td><td data-bbox="851 365 994 411">-0.16</td></tr> <tr><td data-bbox="349 416 539 462">24.40</td><td data-bbox="546 416 692 462">81.33</td><td data-bbox="698 416 844 462">1.91</td><td data-bbox="851 416 994 462">-0.22</td></tr> <tr><td data-bbox="349 467 539 513">24.59</td><td data-bbox="546 467 692 513">70.26</td><td data-bbox="698 467 844 513">1.85</td><td data-bbox="851 467 994 513">-0.39</td></tr> <tr><td data-bbox="349 518 539 564">24.67</td><td data-bbox="546 518 692 564">61.68</td><td data-bbox="698 518 844 564">1.79</td><td data-bbox="851 518 994 564">-0.48</td></tr> <tr><td data-bbox="349 569 539 616">24.73</td><td data-bbox="546 569 692 616">54.96</td><td data-bbox="698 569 844 616">1.74</td><td data-bbox="851 569 994 616">-0.57</td></tr> <tr><td data-bbox="349 620 539 667">24.77</td><td data-bbox="546 620 692 667">49.54</td><td data-bbox="698 620 844 667">1.69</td><td data-bbox="851 620 994 667">-0.64</td></tr> <tr><td data-bbox="349 671 539 718">24.80</td><td data-bbox="546 671 692 718">45.09</td><td data-bbox="698 671 844 718">1.65</td><td data-bbox="851 671 994 718">-0.70</td></tr> <tr><td data-bbox="349 722 539 769">24.83</td><td data-bbox="546 722 692 769">41.38</td><td data-bbox="698 722 844 769">1.62</td><td data-bbox="851 722 994 769">-0.77</td></tr> </tbody> </table> <p data-bbox="349 802 629 903">D 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																																								

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