Cambridge International AS & A Level

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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 HC*l*) or both form copper(II) chloride	**1**
1(a)(ii)	(Transfer) 12.5(0) cm^3 of (10.0 mol dm^{-3}) HC*l* 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**
	curved line (from origin) to reach a plateau, e.g. 	**1**

Question	Answer	Marks
1(a)(vi)	Any sensible attempt seen to make the experiment accurate If mass loss Reduce risk of mass loss through spraying Insert cotton wool plug If gas collection Any method to reduce risk of gas loss Check apparatus is sealed Insert bung quickly Any attempt to measure temperature Check apparatus is at room temperature Apparatus accuracy Use an accurate or 2dp (or more) balance / gas syringe / measuring cylinder	**1**
1(a)(vii)	mol of $CuCO_3$ = 0.5 ÷ 123.5 = 4.05×10^{-3} mol	**1**
	moles of HCl = $2 \times 4.05 \times 10^{-3} = 8.10 \times 10^{-3}$ mol **and** volume of HCl = 8.10×10^{-3} ÷ 0.500 = 0.0162 dm^3 = 16.2 cm^3	**1**

Question	Answer	Marks
1(b)	Any suitable precaution relating to stated hazard of given chemical For HCl Precaution (lab) gloves Explanation (10 mol dm^{-3}) HCl is corrosive For $CuCO_3$ Precaution (lab) gloves / wash hands (after use) / face or mouth mask Explanation Harmful if swallowed	**1**
1(c)(i)	moles of $H_2SO_4 = 0.40 \cdot \frac{24.15}{1000} = 9.66 \cdot 10^{-3}$ mol	**1**
	mass of $Cu_3(CO_3)_2(OH)_2 = 344.5 \cdot 9.66 \cdot 10^{-3} \mid 3 = 1.11$ g	**1**
	% by mass = $\frac{1.11}{1.50} \cdot 100\% = 74.0\%$	**1**

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

Question	Answer	Marks
2(a)(i)	<table><tr><th>Difference in conc. D</th><th>$\frac{D}{m}$</th><th>$\log(\frac{D}{m})$</th><th>log[X]</th></tr><tr><td>24.04</td><td>120.20</td><td>2.08</td><td>–0.02</td></tr><tr><td>24.31</td><td>97.24</td><td>1.99</td><td>–0.16</td></tr><tr><td>24.40</td><td>81.33</td><td>1.91</td><td>–0.22</td></tr><tr><td>24.59</td><td>70.26</td><td>1.85</td><td>–0.39</td></tr><tr><td>24.67</td><td>61.68</td><td>1.79</td><td>–0.48</td></tr><tr><td>24.73</td><td>54.96</td><td>1.74</td><td>–0.57</td></tr><tr><td>24.77</td><td>49.54</td><td>1.69</td><td>–0.64</td></tr><tr><td>24.80</td><td>45.09</td><td>1.65</td><td>–0.70</td></tr><tr><td>24.83</td><td>41.38</td><td>1.62</td><td>–0.77</td></tr></table> D data correct [1] log[X] data correct [1] All data to 2 dp [1]	**3**
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**