CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Level

MARK SCHEME for the May/June 2013 series

9701 CHEMISTRY

9701/52 Paper 5 (Planning, Analysis and Evaluation), maximum raw mark 30

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.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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Question	Expected Answer	Mark
1 (a) (i)	(Solubility will) decrease	1
	Dissolving/reaction is exothermic so reaction is shifted left (owtte)	1
	Increase negates both marks.	
	Allow: Variations in the wording but the word exothermic/heat evolved (or endothermic/heat absorbed for the reverse process) must be included.	
(ii)	Axes are correctly labelled **AND** graph is a curve/straight line showing a decrease in solubility with temperature (ignore units)	1
	Graph goes through the point 25 °C, 1 g dm^{-3} **AND** goes from 0 °C to 100 °C	1
	(Allow ecf from **(i)**.)	
(b)	**(i)** temperature	
	(ii) solubility (of calcium hydroxide)	1
(c) 1	$Ca(OH)_2 + 2HCl \rightarrow CaCl_2 + 2H_2O$	1
2	Pipette (5, 10, 20, 25 or 50 cm^3), burette (25, 50 or 100 cm^3)	1
3	Named indicator with colours in acid and alkaline solution.	1
4	Concentration of $Ca(OH)_2$ = 0.0135 mol dm^{-3}	1
5	Describes making a solution of HCl in volumetric flask which must include using a burette or pipette to take a volume of HCl and making it up to the mark with water.	1
6	Suggests a dilution of HCl of between 50 and 100 fold **OR** suggests a mixture of HCl and water that would give a dilution of between 50 and 100 fold.	1
7	Titration is repeated to achieve concordant/average titre.	1
8	Moles of HCl calculated from titre **AND** $Ca(OH)_2$ = 0.5 x moles of HCl **AND** concentration of $Ca(OH)_2$ is deduced.	1
(d)	Calcium hydroxide **OR** **2.00 mol dm^{-3}** hydrochloric acid are irritants.	1
	Eye protection must be worn. Eye protection can be goggles, glasses, face masks etc.	1
		[Total: 15]

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2 (a) 159.6 **AND** 18.0 — **1**

(b)

Columns are headed with label and correct expression and units. — **1**

mol of $CuSO_4$ **AND** mol of H_2O are correct to 3 sig figs. — **1**

ECF incorrect M_r **or** the use of incorrect expressions into data

D	E	F	G
$CuSO_4$ C – A / g	**H_2O B – C / g**	**Mol $CuSO_4$ D / 159.6 / mol**	**Mol of H_2O E / 18.0 / mol**
1.00	0.56	0.00627	0.0311
1.15	0.65	0.00721	0.0361
1.28	0.72	0.00802	0.0400
1.34	0.76	0.00840	0.0422
1.42	0.85	0.00890	0.0472
1.53	0.81	0.00959	0.0450
1.60	0.90	0.0100	0.0500
1.72	0.97	0.0108	0.0539
1.85	1.04	0.0116	0.0578
1.97	1.11	0.0123	0.0617

(c)

x-axis labelled '$CuSO_4$' and *y*-axis 'H_2O' **AND** plotted points cover at least half the grid in both directions **AND** scales must be uniform including the origin if used. — **1**

All 10 points plotted correctly. — **1**

Best fit straight line drawn. — **1**

(d)

Points 5 and 6 circled — **1**

Point 5 (mass of crucible = 15.05) The anhydrous $CuSO_4$ had decomposed **OR** prior to heating the crucible/sample was wet **OR** contained an impurity which decomposed/was removed on heating. — **1**

Allow: some mass lost (spits) on heating

Point 6 (mass of crucible = 14.90) Not all the water had been driven off the copper sulfate crystals **OR** anhydrous copper sulfate absorbed some water **OR** has an impurity that does not decompose — **1**

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(e)	Appropriately drawn lines on the graph. Correctly read values from the graph. (Figures from the table allowed if no construction lines drawn providing graph does actually go through the points used.) Correctly calculated value of the slope given to 2 or more sig figs up to calculator value using the candidate's figures **AND** with no units given.	**1** **1** **1**
(f)	Most of the points are on the line **OR** only a few points are not on the line **OR** there are only a few anomalies	**1**
(g) (i)	$CuSO_4.5H_2O$ ecf on slope in **(e)**	**1**
(ii)	The graph / slope is the ratio of H_2O:$CuSO_4$ is 5 / 5:1 **OR** the slope is the value of x	**1**
		[Total: 15]

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