



MARK SCHEME for the May/June 2013 series

9701 CHEMISTRY

9701/51

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.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the May/June 2013 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.

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	GCE AS/A LEVEL – May/June 2013	9701	51

Question	Expected Answer	Mark
1 (a) (i)	(Solubility will) decrease	1
	Dissolving/reaction is exothermic so reaction shifts left (owtte).	1
	Increase negates both marks. Allow: Variations in the wording but the word exothermic or heat evolved or 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 on temperature scale and 5 on solubility scale AND goes from 0 to 100 °C	1
	Allow ecf from (i) prediction.	
(b)	(i) temperature (increase)	
	(ii) solubility (of chlorine)	1
(c)	1 Pipette (5, 10, 20, 25, 50 cm ³), burette (25, 50 or 100 cm ³) both required for mark.	1
	2 Starch indicator AND blue/blue-black AND colourless/opaque.	1
	3 Concentration of Cl ₂ = 0.0704 mol dm ⁻³ .	1
	4 Calculates M _r of Na ₂ S ₂ O ₃ .5H ₂ O as 248.2 AND calculates mass with unit required for a solution of stated concentration and volume. (Allow any concentration)	1
	5 Mass and volume used must produce a solution twice as concentrated as the chlorine solution (ecf from Cl ₂).	1
	6 Describes making of solution in <u>volumetric flask</u> which must include: <u>dissolving</u> , making up <u>to mark</u> .	1
	7 Titration is repeated to achieve concordant titration results/average titre, 'concordant' not required if meaning clear.	1
	8 Calculates moles Cl ₂ in titration from 0.5 × moles thiosulfate in titre and therefore concentration AND concentration of Cl ₂ in mol dm ⁻³ in aqueous chlorine. Allow any explanation which covers these points, calculations involving concentrations or moles to mass and concentration in g dm ⁻³ , or any formula that would produce a correct answer e.g. $mv / n = mv / n$	1

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(d)	Chlorine OR iodine are harmful		1
	Wear a mask/use a fume cupboard/for iodine if harmful to skin/eyes given, allow resistant gloves/goggles		1
		[Total: 15]	

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2 (a)	151.9 AND 18.0	1																																																
(b)	Columns are headed with a label, an expression and units as below. Mol of FeSO₄ AND mol of H₂O are correct to 3 sig. figs. ECF incorrect <i>M_r</i>. ECF the use of incorrect expressions into data. <table><tr><th>D</th><th>E</th><th>F</th><th>G</th></tr><tr><td>FeSO₄ (C – A) / g</td><td>H₂O B – C / g</td><td>FeSO₄ (C – A) / 151.9 OR D / 151.9 mol OR mole</td><td>H₂O (B – C) / 18 OR E / 18 mol OR mole</td></tr><tr><td>1.00</td><td>0.83</td><td>0.00658</td><td>0.0461</td></tr><tr><td>1.31</td><td>1.00</td><td>0.00862</td><td>0.0556</td></tr><tr><td>1.30</td><td>1.08</td><td>0.00856</td><td>0.0600</td></tr><tr><td>1.39</td><td>1.16</td><td>0.00915</td><td>0.0644</td></tr><tr><td>1.50</td><td>1.24</td><td>0.00987</td><td>0.0689</td></tr><tr><td>1.63</td><td>1.35</td><td>0.0107</td><td>0.0750</td></tr><tr><td>1.78</td><td>1.48</td><td>0.0117</td><td>0.0822</td></tr><tr><td>1.84</td><td>1.53</td><td>0.0121</td><td>0.0850</td></tr><tr><td>1.95</td><td>1.62</td><td>0.0128</td><td>0.0900</td></tr><tr><td>2.03</td><td>1.76</td><td>0.0134</td><td>0.0978</td></tr></table>	D	E	F	G	FeSO ₄ (C – A) / g	H ₂ O B – C / g	FeSO ₄ (C – A) / 151.9 OR D / 151.9 mol OR mole	H ₂ O (B – C) / 18 OR E / 18 mol OR mole	1.00	0.83	0.00658	0.0461	1.31	1.00	0.00862	0.0556	1.30	1.08	0.00856	0.0600	1.39	1.16	0.00915	0.0644	1.50	1.24	0.00987	0.0689	1.63	1.35	0.0107	0.0750	1.78	1.48	0.0117	0.0822	1.84	1.53	0.0121	0.0850	1.95	1.62	0.0128	0.0900	2.03	1.76	0.0134	0.0978	1 1
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(c)	x-axis labelled ‘mol of FeSO₄’ and y-axis ‘mol H₂O’ AND plotted points cover at least half the grid in both directions. Allow a correct letter from the table as a label. All 10 points plotted correctly. Best fit straight line drawn.	1 1 1																																																

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(d)	Points 2 and 10 circled. (The circled points must be unambiguously referred to in the reasons.)	1
	Point 2 (mass of crucible 15.10) Not all the water had been driven off the iron sulfate crystals OR anhydrous FeSO_4 absorbed some water OR has an impurity that does not decompose.	1
	Allow water loss is low(er) (than expected).	
	Point 10 (mass of crucible = 15.01) The anhydrous FeSO_4 had decomposed OR prior to heating the crucible/original sample was wet and water removed on heating OR contained an impurity which decomposed/was removed on heating.	1
	Allow some mass lost (spits out) on heating.	
(e)	Appropriately drawn lines on the graph.	1
	Correctly read values from the graph.	1
	(Figures from the table allowed if no construction lines drawn providing graph drawn does actually go through the points used.)	
	Correctly calculated value of the slope given to 2 or more sig. figs up to calculator value and using the candidate's figures AND no units given.	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)	$\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ (ecf on slope in (e))	1
(ii)	The gradient/slope is the ratio of (moles) of $\text{H}_2\text{O}:\text{FeSO}_4$ (is 7 or 7:1).	1
		[Total: 15]