CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Level

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.

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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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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 $Na_2S_2O_3.5H_2O$ 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.	1
	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	

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(d)	Chlorine **OR** iodine are harmful Wear a mask/use a fume cupboard/for iodine if harmful to skin/eyes given, allow resistant gloves/goggles	**1** **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. — **1**

Mol of $FeSO_4$ **AND** mol of H_2O are correct to 3 sig. figs. — **1**

ECF incorrect M_r. ECF the use of incorrect expressions into data.

D	E	F	G
$FeSO_4$ (C – A) / g	**H_20 B – C / g**	**$FeSO_4$ (C – A) / 151.9 OR D / 151.9 mol OR mole**	**H_2O (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

(c) *x*-axis labelled 'mol of $FeSO_4$' and *y*-axis 'mol H_2O' **AND** plotted points cover at least half the grid in both directions. — **1**

Allow a correct letter from the table as a label.

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

Best fit **straight** line drawn. — **1**

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(d)	Points 2 and 10 circled. (The circled points must be unambiguously referred to in the reasons.) 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. 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. Allow some mass lost (spits out) on heating.	**1** **1** **1**
(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 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** **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)	$FeSO_4.7H_2O$ (ecf on slope in **(e)**)	**1**
(ii)	The gradient/slope is the ratio of (moles) of H_2O:$FeSO_4$ (is 7 or 7:1).	**1**
		[Total: 15]

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