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Cambridge International Advanced Subsidiary and Advanced Level

MARK SCHEME for the October/November 2015 series

9701 CHEMISTRY

9701/36 Paper 3 (Advanced Practical Skills 2), maximum raw mark 40

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Question	Indicative material	Mark	Total
1 (a)	**I** Constructs a single table for 6 results.	1	
	II Correct headings and units. Volumes / V/vol in cm^3 or / cm^3 or (cm^3), time / t in seconds or / s or (s).	1	
	III All times recorded to the nearest second and all volumes to 0.05 cm^3.	1	
	IV Four further experiments chosen with intervals not less than 2 cm^3 and no volume less than 6 cm^3. At least one volume must be less than 10 cm^3 and at least one must be more than 10 cm^3.	1	
	V Water added to make total volume of **FB 1** and water 20 cm^3 in each experiment and no other changes in volume.	1	
	VI Times increase with decrease in volume **FB 1.**	1	
	VII and VIII Examiner rounds times to nearest second and calculates (time for expt 2) / (time for expt 1) to 2 dp**.** Ratio is compared with that of Supervisor. Award marks as follows: **VI** if ratio within 0.2 of Supervisor. **VII** if ratio within 0.1 of Supervisor.	1 1	[8]
(b)	**(i)** number of moles $S_2O_3^{2-} = 1.2 \times 10^{-4}$	1	
	(ii) Correctly calculates answer to **(i)** / 2 = 0.6×10^{-4} **and** **(iii)** answer to **(ii)** $\times$ 2 = 1.2×10^{-4}.	1	
	(iv) Correct **expression** $\frac{1.2\times10^{-4}}{0.06} = 2.(0) \times 10^{-3}$	1	
	(v) Rates correctly calculated using $\frac{\textbf{(c)(iv)}\times10^{6}}{t}$	1	
	Units for rate given as mol dm^{-3} s^{-1} **and** 3 correct columns used.	1	[5]
(c)	**I** Axes labelled – rate on *y*-axis and volume or **FB 1** / cm^3 on *x*-axis	1	
	II Uniform scales to use at least half of each axis including 0,0 if point plotted.	1	
	III Correct plotting – all points recorded plotted and within half a small square and within correct small square.	1	

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	IV Draws a line of best fit. (can be straight line or curve). *Straight lines must be straight (single line with no kinks, drawn using a ruler) or a smooth curve (gradual change in gradient). Points not on the line must be balanced on either side of the best fit line but any points ringed or labelled as anomalous should be ignored.*	1	[4]
(d)	Rate increases as concentration of Fe^{3+} increases Comment on graph as drawn. *Possible comments include:* *The results are consistent since all points are on/near the line.* *An anomalous point is present/or not present.* *Would have expected graph to go through 0,0.* *Straight line shows rate proportional to conc/vol*	1 1	[2]
(e)	Alter volume of **FB 2**/KI whilst keeping other volume of **FB 1**/$FeCl_3$ constant Add water to keep total volume constant	1 1	[2]
(f)	**Modification 1** Reaction time less. (Less accurate since) larger **%** error (in time). **Modification 2** Reaction time stays the same (Less accurate since) greater % error in volume.	 1 1 1 1	[4]
(g)	**(i)** Experiment with shortest reaction time **(ii)** Correct **expression** $\frac{0.5 \times 100\%}{\text{smallest reaction time}}$	1 1	[2]
			[Total: 27]

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FB 4 $Cu(NH_4)_2(SO_4)_2.6H_2O$, **FB 5** $Fe(NH_4)(SO_4)_2.6H_2O$, **FB 6** $C_6H_{12}O_6$

2 (a) (i)

FB 4	**FB 5**	
colour to dark(er) / deep blue	no change / no reaction.	1
brown (solution) (+ off-white / beige ppt)	no reaction / no change / no ppt	1
blue ppt. insol. in excess	green ppt. insol in excess / goes brown	
blue ppt. soluble in excess to give dark blue solution	green ppt. insol in excess / goes brown	1
white ppt. **and** insol in HC*l* / no change	white ppt **and** insol in HC*l* / no change	1
		1 [5]

(ii) Anion present in both is SO_4^{2-} / sulfate **and** **FB 4** Cu^{2+} / copper(II) **and** **FB 5** Fe^{2+}/iron(II) — 1 [1]

(iii) Heat with (aqueous) sodium hydroxide. Ammonia / gas given off that turns litmus blue — 1

Cation is NH_4^+ / ammonium — 1 [2]

(b) (i) Manganate (VII) changes from purple to colourless. — 1

Silver colour / grey ppt / black ppt / silver mirror — 1 [2]

(ii) Aldehyde and / or ketone (both needed) / carbonyl compound / functional group is C=O. — 1 [1]

(iii) Aldehyde — 1 [1]

(iv) +1 to 0 — 1 [1]

[Total: 13]

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