## UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

**GCE Advanced Subsidiary Level and GCE Advanced Level** 

## MARK SCHEME for the May/June 2012 question paper for the guidance of teachers

## 9701 CHEMISTRY

9701/32

Paper 32 (Advanced Practical Skills 2), maximum raw mark 40

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 must be read in conjunction with the question papers and the report on the examination.

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Question	Sections	Indicative material	Many B
1 (a)	PDO layout	I Constructs a table for results (minimum of 3 results).	Mannon 1
	PDO recording	II Appropriate headings and units for data given. Volume/V in cm³ or / cm³ or (cm³) Time/t in seconds or / s or (s)	1
	PDO recording	III All times recorded to the nearest second.	1
	MMO decision	IV 3 additional volumes chosen with intervals not less than 2.00 cm³ and all volumes of <b>FB 1</b> greater than or equal to 6.00 cm³	1
	MMO collection	V In all 3 additional experiments water is added to make a total of 20.00 cm <sup>3</sup>	1
	MMO quality	Round times to nearest second.  VI + VII Compare time for 20.00 cm <sup>3</sup> of FB 1 with that of supervisor.	2
		VIII + IX Compare time for 10.00 cm <sup>3</sup> of FB 1 with that of supervisor.  The range for award of 1 or 2 depends on the supervisor value.	2
		Supervisor value: $<$ or = 15 $\delta$ for 2 is 2 and for 1 is 4 16 to 30 $\delta$ for 2 is 3 and for 1 is 6 31 to 45 $\delta$ for 2 is 4 and for 1 is 8 46 to 60 $\delta$ for 2 is 5 and for 1 is 10 $>$ 60 $\delta$ for 2 is 6 and for 1 is 12	[9]
(b)	PDO display	(i) Working to show ans = 1 × 10 <sup>-4</sup> mol. Expression and answer.	1
	ACE interpretation	(ii) 0.5 × ans to (i) = 5 × 10 <sup>-5</sup> mol AND (iii) 2 x ans to (ii) = 1 × 10 <sup>-4</sup>	1
	PDO display	(iv) $(1 \times 10^{-4}) / 0.060 = 1.67 \times 10^{-3} \text{ mol dm}^{-3}$ .	1 [3]
(c)	ACE interpretation	Minimum of 4 results – rate correctly calculated in each case using ans <b>(b)(iv)</b> × 10 <sup>6</sup> / time (or 2.25 × 10 <sup>-3</sup> ). Min 2 s.f. rounded correctly.	1
	PDO recording	Units for rate given as mol dm <sup>-3</sup> s <sup>-1</sup>	1 [2]

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Question	Sections	Indicative material	17/16
(d)	PDO layout	I Rate on <i>y</i> -axis and volume on <i>x</i> -axis. Axes clearly labelled	1 1
		Linear scale chosen to use at least half of each axis (need not include 0,0)  If no point at 0, 0 cannot count for > half.	1
		III Plotting of points.  Minimum of 3 readings.	1
		IV Draws a line of best fit.  Minimum of 4 readings including 0, 0 (if plotted).	1
(e)	ACE conclusion	Rate is (directly) proportional to Fe <sup>3+</sup> concentration. Rate increases as concentration (volume) increases would score one	2 [2]
(f)	ACE	(i) 2 × 0.05 / 0.1	1
		0.10 / 20.00 × 100 = 0.5% 0.25 scores 1 mark. No ecf.	1
		(ii) Difficult to judge colour change / measurement of reaction time / some thiosulfate reacting with acid / formation of (S) ppt / variation in T.	1
	ACE improvement	(iii) Investigate reaction between Fe <sup>3+</sup> and S <sub>2</sub> O <sub>3</sub> <sup>2-</sup>	1 [4]
(g)	ACE conclusion	(ii) Thiosulfate concentration / number of moles / volume is halved (1) Time is shorter / reaction is faster with less	2

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Question	Sections	Indicative mater	rial		776
<b>FB 5</b> = H <sub>2</sub> SO <sub>4</sub>	; <b>FB 6</b> = K <sub>2</sub> CrO <sub>4</sub> ; <b>FB</b>	7 = BaCl <sub>2</sub> ; <b>FB 8</b>	= Pb(NO <sub>3</sub> ) <sub>2</sub> ; <b>FB</b>	<b>9</b> = NaNO <sub>2</sub>	
2 (a)	MMO collection	Orange solution (1)	White ppt <b>and</b> (white ppt in RH column)	White ppt (1)	Cambi
			Yellow/cream ppt (1)	Yellow ppt (1)	
				White ppt (1)	[5
Ignore excess	of any reagent.				
(b)	ACE conclusion	Pb <sup>2+</sup> in <b>FB 8 AND</b> Ba <sup>2+</sup> in <b>FB 7</b>		1	
		H <sup>+</sup> in <b>FB 5 AND</b> CrO <sub>4</sub> <sup>2-</sup> in <b>FB 6</b>			1
		SO <sub>4</sub> <sup>2-</sup> in <b>FB 5 AND</b> Cl <sup>-</sup> in <b>FB 7</b>			1 [3
(c)	MMO decision	I Warms with	NaOH and A <i>l</i> in (	i).	1
	MMO decision	II Adds named	(dilute) acid in <b>(i</b> i	<b>)</b> .	1
	PDO recording	III Presents observations in a single table – no extra reagents in (iii).		1	
	MMO collection	IV Ammonia / g If ammonia r that affects t		ue in <b>(iii)</b> . ssume it is the gas	1
	MMO collection	V Brown fumes	s (of NO <sub>2</sub> ) / gas th <b>(iii)</b> .	at turns blue	1
	ACE conclusion	VI nitrite (needs	s evidence).		1 [6
		,		[Т	otal: 14