CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2013 series

9701 CHEMISTRY

9701/34 Paper 34 (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 should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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Question	Sections	Indicative material	Mark	Total
1 (a)	PDO layout	**I** Constructs one table for all 7 results. *(Table does not need lines, does need something entered for each experiment)*	1	
	PDO recording	**II** Appropriate headings and units for data given. Volume in cm^3 or $/cm^3$ or (cm^3). Temperature in °C or /ºC or (ºC). *(**All 4** correct headings and units must appear in the table.)*	1	
	PDO recording	**III** All temperatures recorded to the nearest 0.5 °C both in the table **and for T_1**, at least one of the readings must be .5 (others .0) or vice versa.	1	
	ACE interpret-ation	**IV** Correctly calculates all 7 temperature rises *(from the table(s)).*	1	
	MMO quality	**V + VI** Compare temp rise for addition of 14 cm^3 of **FB 1** with Supervisor value. Default value = 11.0 °C Award 2 marks for ΔT within ± 1.0 °C. Award 1 mark for ΔT within ± 2.0 °C.	2	[6]
(b) (i)	PDO layout	**I** ΔT on *y-axis* and volume of **FB 1** on *x-axis*. Axes clearly labelled (ignore units).	1	
		II Linear scale chosen to go at least 2 ºC above highest reading and to be a minimum of **6** squares vertically including the 2 ºC; minimum 5 large squares for volume.	1	
		III **All** points plotted to within half a small square (6 min).	1	
(ii)	ACE interpret-ation	**IV** Draws both straight lines of best fit.	1	
(iii)		**V** Reads correctly the value of **FB 1** from the intercept of the two lines.	1	[5]

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(c) (i) and (ii)	ACE interpret-ation	**I** Correctly calculates $\frac{2.00\ x\ (b)(iii)}{1000}$ **and** same answer for **(c)(ii)**	1	
(iii)		**II** Correctly calculates $\frac{1000\ x\ (c)(ii)}{[30.00-(b)(iii)]}$	1	
	PDO Display	**III** Show use of 2 × **(b)(iii)**/1000 in **(i) and** all 3 answers to 3 or 4 sf	1	[3]
(d)	ACE interpret-ation	Any two of: • change in volume makes no difference to the accuracy as temp rise the same • decreased accuracy as less accurate measurement of volume with reference to measuring cylinder or burette (comparative needed or reference to precision/calibration or % error) • more accurate as greater number of experiments so more points to get an accurate intercept or better lines of best fit	2	[2]
				[Total: 16]

2 (a)	MMO collection	**I** Initial and final volumes recorded for rough **and** initial, final and volume added recorded for accurate titrations.	1	
	PDO recording	**II** All accurate burette readings recorded to 0.05 cm^3. *Do **not** award this mark if:* *50(.00) is used as an initial burette reading;* *more than one final burette reading is 50(.00);* *any burette reading is greater than 50(.0).*	1	
	MMO decision	**III** Two uncorrected accurate titres within 0.1 cm^3. Do not award if, having performed two titres within 0.1 cm^3, a further titration is performed that is more than 0.1 cm^3 from the closer of the original 2 titres unless a further titration has been carried out which is within 0.1 cm^3 of any others. Do not award if titres from burette readings to no dp are used (apart from use of 0 for initial reading).	1	

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Examiner rounds any accurate burette readings to the nearest 0.05 cm^3, checks subtractions and then selects the 'best' titres for Supervisor and candidate using the hierarchy:
two identical; titres within 0.05 cm^3; titres within 0.1 cm^3; etc.
to calculate mean correct to 0.01 cm^3.
Examiner compares candidate mean titre with Supervisor mean titre.

(a) (cont.)	MMO quality	**IV + V** Award 2 marks if $\delta \leq 0.20\,cm^3$. Award 1 mark if $0.20 < \delta \leq 0.50\,cm^3$. *If best titres are ≥ 0.50 cm^3, cancel one of the Q marks.*	2	[5]
(b)	ACE interpret-ation	Check mean titre is correctly calculated from clearly selected values (ticks or working). Candidate must average two (or more) titres that are within 0.20 cm^3 of each other. Working must be shown or ticks must be put next to the two (or more) accurate readings selected. *The mean should normally be quoted to 2 dp rounded to the nearest 0.01.* *Two special cases where the mean may not be to 2 dp: allow mean to 3 dp only for 0.025 or 0.075 eg 26.325; allow mean to 1 dp if **all** accurate burette readings were given to 1 dp and the mean is exactly correct. eg 26.0 and 26.2 = 26.1 is correct but 26.0 and 26.1 = 26.1 is incorrect.* *Note: the candidate's mean will sometimes be marked as correct even if it is different from the mean calculated by the examiner for the purpose of assessing accuracy.*	1	[1]
(c)	ACE interpret-ation	**I** **(i)** Correctly calculates $0.2 \times$ **(b)**/1000 **and** same ans in **(ii)** to 3 or 4 sf	1	
		II **(c)(ii)** $\times$ 400	1	
	PDO display	**III** Working in the correct direction shown in **(i)** and **(iii)**.	1	[3]
				[Total: 9]

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FB 5 is NaOH(aq); **FB 6** is $FeSO_4$(aq); **FB 7** is ($Zn(NO_3)_2$ + KI)(aq); **FB 8** is $Pb(NO_3)_2$(aq); **FB 9** is Na_2SO_4(aq)

(a)	MMO collection	**I** **FB 5** and **FB 6**: a green ppt, insol in excess	1	
		II turning brown/darkening	1	
		III **FB 5** and **FB 7**: a white ppt, sol in excess	1	
		If excess omitted in the tests above then allow 1 mark for three correctly coloured ppts.		
		IV **FB 5** and **FB 8**: white ppt, sol in excess	1	
		V **FB 6** and **FB 7**: no reaction/no change *(**not** dash)* (ignore any ref to solution turning yellow/orange/brown)	1	
		VI **FB 6** and **FB 8**: white ppt **and** **FB 7** and **FB 8**: yellow ppt	1	[6]

(b)

ion	Fe^{2+}	Pb^{2+}	Zn^{2+}	I^-	OH^-	SO_4^{2-}
solution	**FB 6**	**FB 8**	**FB 7**	**FB 7**	**FB 5**	**FB 6**

(b)	ACE conclusion	6 correct scores 3 marks 5 correct scores 2 marks 3 or 4 correct scores 1 mark *(freestanding marks)*	3	[3]
(c)	MMO decision	(Aqueous) $BaCl_2$ or $Ba(NO_3)_2$ **and** HCl or HNO_3 (or names) or $Pb(NO_3)_2$ **and** HNO_3 *(either way round but check that obs fit)* **or** add HCl, HNO_3, H_2SO_4 **and** observe fizzing with SO_3^{2-} **or** test gas with (acidified) dichromate/ manganate(VII) **or** add acidified sodium/potassium dichromate/ manganate(VII) (to solution) with SO_3^{2-}: colour change from orange/purple to green/colourless or decolourises	1	
	MMO collection	White ppt insol/no gas/no (further) reaction in acid **or** no reaction/no gas/no colour change of indicator *(from obs) (with Ba^{2+} route may gain reagent mark if suitable acid is only named in obs)* **or** no colour change of solution/ *(from obs)* **and** SO_4^{2-} identified	1	[2]

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(d)	MMO decision	**I** Choice of first reagent from following list *(any)*	1	
	ACE con-clusion	**II** Correct deduction(s) from correct positive obs.	1	
	MMO decision	**III** Choice of second reagent which is capable of distinguishing between the pair** (e.g. carbonate / dichromate pairing cannot be credited as cannot identify if the two are ethanol and ethanal; ditto Tollens' and Na)	1	
	ACE con-clusion	**IV** Correct deduction from correct obs.	1	[4]
				[Total: 15]

** If both tests identify the same compound, award marks for the higher scoring answer.

reagent	ethanol	ethanal	ethanoic acid
*acidified potassium (or sodium) dichromate	orange/solution turns green	orange/solution turns green	(no reaction)
*acidified potassium manganate(VII)	purple/solution turns colourless/pale pink	purple/solution turns colourless/pale pink	(no reaction)
Brady's (2,4–DNP(H))	(no reaction)	yellow-orange/ orange/red ppt	(no reaction)
Tollens'/ammoniacal silver nitrate	(no reaction)	silver (mirror) grey/black ppt	(no reaction)
Fehling's	(no reaction)	orange/red/orange-brown/red-brown ppt	(no reaction)
Benedict's	(no reaction)	orange/red/orange-brown/red-brown ppt	(no reaction)
named carbonate or hydrogen carbonate	(no reaction)	(no reaction)	effervescence/ gas which turns limewater milky
magnesium	(no reaction)	(no reaction)	effervescence/ gas which pops with lighted splint

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sodium	effervescence/ gas which pops with lighted splint	(no reaction)	effervescence/ gas which pops with lighted splint
sodium hydroxide + ref to checking temperature	(no reaction)	(no reaction)	temp increases
named indicator (not phenolphthalein)	(no reaction)	(no reaction)	turns correct final colour
named alcohol + c. H_2SO_4 warm/heat	(no reaction)	(no reaction)	sweet/fruity/ester smell
named carboxylic acid + c. H_2SO_4 & warm/heat	sweet/fruity/ester smell	(no reaction)	(no reaction)
PCl_5 or PCl_3/$SOCl_2$	misty/steamy fumes	(no reaction)	misty/steamy fumes
triiodomethane test/ I_2+NaOH	(pale) yellow ppt	(pale) yellow ppt	(no reaction)
named –oyl chloride	sweet/fruity/ester smell	(no reaction)	(no reaction)

* deduction marks allowed from no acidification/H^+

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