CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2012 series

9701 CHEMISTRY

9701/34 Paper 3 (Advanced Practical Skills), 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.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the October/November 2012 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components

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Question	Sections	Indicative material	Mark	
1 (a)	PDO Recording	**I** Correct units given for time and rates columns: / s or (s) and / s^{-1} or (s^{-1})	1	
		II Records all 5 times to the nearest second. Do not allow if $t_1 > t_3$.	1	
	PDO Display	**III** **All** (1000/time) values are correctly evaluated to 3 sig fig using the candidate's recorded times. (Minimum of 3 experiments carried out.)	1	
	MMO Quality	**IV** to **IX** Use the method given in the notes below when awarding the Quality marks.	6	[9]
	Round all reaction times to the nearest second. **IV** and **V** Experiments 2 and 4: calculate $100(2t_2 – t_4)/t_4 \leq 20\%$ for 1 mark; $\leq 10\%$ for 2 marks. **VI** and **VII** Experiments 2 and 5: calculate $100(4t_2 – t_5)/t_5 \leq 20\%$ for 1 mark; $\leq 10\%$ for 2 marks. **VIII** and **IX** Experiments 4 and 5: calculate $100(2t_4 – t_5)/t_5 \leq 30\%$ for 1 mark; $\leq 10\%$ for 2 marks. If the candidate has not completed the 5th experiment, marks **IV** and **V** are available. Also check Experiments 1 and 2: t_2 should equal t_1 x 5/4. Use the 10% and 20% boundaries. If only the first three experiments are completed, award Q marks based on Experiments 1 and 2 (as above).			
(b)	PDO Layout	**I** Plots (1000/time) on *y*-axis and volume of **FB 1** on *x*-axis. Axes correctly labelled and correct unit included with volume heading.	1	
		II Uniform scales selected and more than half of the available grid used. Scales must start at (0,0).	1	
		III **All** results are plotted within ½ square and in correct square. Allow for minimum 4 experiments carried out.	1	
		IV Draws a line through the origin (as shown) which lies within the arc of the points.	1	
		V Draws a **straight** line of best fit (origin not essential).	1	[5]

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(c)	ACE Interpretation PDO Display	**(i)** Experiment 1 and 5: correct concentration (to 2 – 4 sf) of hydrogen peroxide in one of the solutions (0.088/0.0885/0.08846 and 0.018/0.0177/0.01769 respectively). Correct concentrations in both and working shown in one. **(ii)** Working to show that concentration of H_2O_2 is proportional to volume of **FB 1**. Use of ratios or multiplying factor **or** statement that total volume is constant / the same in each.	1 1 1	[3]
(d)	ACE Conclusions	**Two** pieces of evidence needed. **If website statement correct** (i) a straight line / (line has) constant gradient (ii) passes through origin **if** graph line is straight (iii) straight line passes through origin (if appropriate from results) gains both marks. **or** **If website statement not correct** (i) a curve has been drawn / no straight line / not constant gradient (ii) straight line does not pass through the origin (iii) points too scattered / not on best fit line. **If no comment on correct / incorrect** Allow 1 mark: for two pieces of evidence A straight line, not passing through the origin could score both marks depending on explanation given (proportional but not directly proportional). If two points are compared they must be on or very close to the graph line.	 1 1	[2]
(e)	ACE Conclusions	Predicts time will be reduced / halved (reference to rate is incorrect; allow time is faster). Explains that smaller amount / moles / volume of thiosulfate are present to delay blue-black colour / less iodine needs to be produced.	1 1	[2]
(f)	ACE Interpretation	Temperature change / concentration of KI / initial concentration of H_2O_2. (NOT catalyst)	1	[1]
(g)	ACE Interpretation	**(i)** Correctly calculates mean = **54.8 only.** **(ii)** Correctly calculates error = **3.6** or **3.65**%. Allow ecf correctly calculated from candidate's answer in **(i)** (3.56 or 3.6% if mean = 56.2).	1 1	[2]
(h)	ACE Improvements	1st experiment: only **FB 2** changes and distilled water adjusted to give 60 cm^3 total **and** 2nd experiment: only **FB 4** changes and distilled water adjusted to give 55 cm^3 total.	1	[1]
				[Total: 25]

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FB 5 is $FeSO_4(aq)$; **FB 6** is $NH_4Cl(aq) + Na_2SO_3(aq)$; **FB 7** is $MgSO_4(aq)$; **FB 8** is $CH_3CO_2Na(s)$

2	**(a)**	PDO Recording	**I** Records all results (in correct space) for unknowns in a single table.	1	
			II Records green ppt, insoluble in excess NaOH for **FB 5** **and** white ppt insoluble in excess NaOH with **FB 7**.	1	
		MMO Collection	**III** Only heats the solution in which no ppt formed with NaOH.	1	
		MMO Decisions	**IV** Tests <u>gas</u> /NH_3 evolved on heating **FB 6** with NaOH with (red) litmus paper turning blue.	1	[4]
	(b)	MMO Collection	With **FB 5** records a green ppt, insoluble in excess ammonia **and** with **FB 7** records a white ppt insoluble in excess ammonia.	1	
			Any evidence of the green ppt with **FB 5** turning brown in tests in **(a)** or **(b).**	1	[2]
	(c)	ACE Conclusions	**No ecf in this section.** **FB 5** contains Fe^{2+}, iron(II) **FB 6** contains NH_4^+, ammonium **FB 7** contains Mg^{2+}, magnesium	1	[1]
	(d)	MMO Decisions	**(i)** Chooses as reagents: barium chloride / nitrate as **first** reagent, **and** hydrochloric / nitric acid as **second** reagent.	1	
		MMO Collection	**(ii)** White ppt for all three with first reagent. (Allow off-white ppt with **FB 5**)	1	
			FB 5 and **FB 7** ppt insoluble **and FB 6** ppt dissolves in second reagent.	1	
			(If acid added before Ba^{2+} then award 3rd mark for white ppt, no reaction, white ppt.)		
		ACE Conclusions	**(iii)** Correctly identifies the ions present **and** explanation from observations: SO_4^{2-} in **FB 5** and **FB 7** as ppt insoluble in (appropriate) acid **or** SO_3^{2-} in **FB 6** as ppt soluble in acid. (*Only allow ecf if same transposition of solutions as in* **(a)**; SO_3^{2-} must be with NH_4^+)	1	[4]

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(e)	MMO Collection	**Either** solution turns yellow / orange / orange-brown / brown (box 1) **or** brown / rust / red-brown ppt formed (box 2) (ppt soluble in excess is incorrect*)*. Other of the above **and** observes effervescence / fizzing / bubbles (in either box). (Allow gas relights glowing splint (in either box) for 3rd observation.)	1 1	[2]
(f)	MMO Collection ACE Conclusion	Test 1: (blue) litmus paper turns red **and** Test 2: sweet / fruity / glue / adhesive / nail varnish smell. Accept smell of ester. Salt of an organic / carboxylic acid or organic salt / named salt of organic acid **or** (A solid/crystalline) organic/carboxylic acid/named organic acid.	1 1	[2]
				[Total:15]

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