UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2009 question paper for the guidance of teachers

9701 CHEMISTRY

9701/51

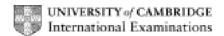
Paper 51 (Planning, Analysis and Evaluation), maximum raw mark 30

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

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Qı	uestion	Sections	Indicative material	Mark
1	(a)	PLAN Problem	Treat section (a) as one answer. From preliminary expt – predicts that rate of reaction will be proportional to [persulfate] / accept 'doubling the concentration doubles the rate'/increasing concentration increases rate. Explains that doubling the concentration doubles the number of collisions/increasing the concentration increases the number of collisions. The use of frequency alone is incorrect but if used with other correct comments regard it as neutral.	[1] [1]
	(b)	PLAN Problem	(i) [Persulfate] as independent variable. Accept the correct ion instead of the correct name. Do not accept volume or amount.	[1]
			(ii) Elapsed time identified as dependent variable / rate (of reaction) or equivalent. Time alone scores zero but rate alone is OK.	[1]
	(c)	PLAN Problem	Explains that [iodide] remains constant – (controlled variable)/so that the iodide does not run out/continuous supply of iodide ions (for reaction with persulfate). NOT allowed are reformed/regenerated alone – rubric.	[1]
	(d)	PLAN Methods	 (i) Has at least 3 more appropriate experiments of lower concentration. (inappropriate experiments negate this mark) (ii) At least one of the diluted (varying water or persulphate) solutions half or less of original correct concentration / uses 20 cm³ or less of persulphate at least once. (if concentration is used alone it must be correct but if used in conjunction with volumes regard the concentration as neutral). (iii) Total volume, volumes of potassium iodide, thiosulfate and starch all constant. (allow drops of starch) (use of the exemplar experiment is not mandatory) If all volumes 	[1] [1]
			stated, then the same procedure (with different persulfate concentrations) repeated could suffice. (iv) Burette or measuring cylinder used to measure volumes of persulfate and distilled water.	[1]
			 (v) 'Minimum' is persulfate and iodide kept apart until reaction stated as started. (vi) Clock stopped when blue colour appears / elapsed time to blue colour is noted / measure time to the appearance of the blue colour. Not in a (timed) titration procedure. Also look at the table in (f) for possible answers to the first three marks. 	[1] [1]
	(e)	PLAN Methods	Explains that the volume / amount of thiosulfate defines the extent of the reaction ("finishing line") to enable comparison – or equivalent statement. Relate the constant volume of thiosulphate to the end / finishing point. Any reference to 'accuracy' should be regarded as neutral'.	[1]

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Question	Sections	Indicative material	Mark
(f)	PLAN Methods	Tabulates volumes or concentrations of persulfate. (Accept concentration if volumes used in text to show diluted solution) and elapsed time. Include unit	[1]
		Includes a column for rate or Vt and unit (cm³s), or concentration x t and unit. (Penalise error or omission in units once only across the three relevant columns) Units for rate (or 1/t) should be /s⁻¹ or /moldm⁻³s⁻¹. allow 'brackets instead of /. (NOT M seconds minutes)	[1]
(g)	PLAN Methods	Must have the first mark in (a). Mark "justification" consequently. 'If the rate increases/time decreases/Vt is constant as the concentration of persulfate increases then the rate is proportional to the concentration of the persulfate'. Check the trend in (f) from time/rate and conc/vol data that may be provided. Accept a plot of rate against concentration having a line of positive slope/or going through the origin, OR a plot of time against concentration having a line of negative slope.	[1]
Qn 1	Total		[15]

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Page 5	Mark Scheme: Teachers' version	Syllabus	Paper	
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Qn 2	Total		[15]
(h)	ACE Conclusion	Suggests titration of iodine with (sodium) thiosulfate.	[1]
(g)	ACE Conclusions	Identifies a single point of weakness in method. Possibly: Small masses weighed / large % error in mass. Not if large % error is related to balance dp or accuracy.	[1]
(f)	ACE Conclusions	Must refer in some way to the general agreement of the calculated/stated ratio being approximately 2 or 1:2 (in (b) or (d) . May have something written below the table in (b) . OR The slope of the graph is approximately 2. OR The moles/atoms/ions of iodine is about double that of zinc. Not references to molecules/mass/weight/I ₂	[1]