UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2010 question paper for the guidance of teachers

9701 CHEMISTRY

9701/53 Paper 5 (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.

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UNIVERSITY of CAMBRIDGE International Examinations

Question	Sections	Indicative material	Mark
1 (a) (i)	PLAN Problem	Qualitative answer only for the first mark. Predicts any direct proportionality. E.g. Increasing concentration increases rate or doubling the molecules per unit volume (concentration) doubles the rate. Could gain this mark from next part. No ecf for opposite answer. Increasing concentration/molecules per unit volume increases frequency of collisions.	[1] [1]
(ii)	PLAN Problem	A diagonal straight-line of positive gradient going through the origin (+/– 1mm). No up or down curves or plateaux. If part **(i)** refers to some description of catalyst saturation, then accept a straight line horizontal plateau after the up straight line.	[1]
(b)	PLAN Problem	Independent variable – <u>concentration</u> of H_2O_2. Do not allow volume/moles/amount. Has to be concentration. Dependent variable – Time for the fixed volume of oxygen (or a stated volume of oxygen) OR time OR time taken. Not rate of reaction (negator) as that is a derived quantity.	[1] [1]
(c)(i)(ii)	PLAN Method	Reaction vessel (conical flask) divided or with a small tube inside for the catalyst or any other internal separation device. Thistle or dropping funnels negate. Ignore heating Syringe or equivalent apparatus (over water) connected to the reaction vessel in an airtight format. The volume of the gas collecting apparatus shown and is not exceeding 1 dm^3.	[1] [1] [1]
(d) (i) **(ii)**	PLAN Method	Completes the table. Correct units required for each column. 0 cm^3 of H_2O_2 not allowed. Total volumes of solutions need not be constant. If reaction vessel mark awarded, give mark for shaking to react (catalyst and solution present). If a thistle or dropping funnel used then mark is for adding the liquid reagent to the catalyst. In other situations give mark for adding solid catalyst to the solution (only) <u>and closing the vessel</u>. Starting the reaction and a stopwatch simultaneously. Accept "start the clock" only if it is unambiguously related to the reaction start. Recording the time taken to produce a chosen/fixed volume of gas (15 cm^3 for example).	[1] [1] [1] [1]
(e)	PLAN Method	Starting the reaction and the stopwatch simultaneously is difficult. Accept any reaction starting process in conjunction with starting the clock. Accept closing the apparatus and starting the clock. Do not accept loss of oxygen whilst closing the bung (neutral).	[1]

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Question	Sections	Indicative material	Mark
(f)	PLAN method	There are 6 marking points which are, Three columns, concentration of hydrogen peroxide, time and rate (or 1/time). Ignore other columns Each column needs a correct unit in correct format i.e. /mol dm^{-3}, /s, s^{-1} or the use of brackets (s). Accept seconds, minutes (not sec, min or m), or not M or molarity. Two marks for 5 or 6 correct points. One mark for 3 or 4 correct points. No marks for 2 or less correct points.	[2]
	Total		**[15]**

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Question	Sections	Indicative material	Mark
2 (a)	ACE Data	One of the two column headings correct in heading, unit and expression. The calculations are correct in both columns (first two and last two in each) and both columns are fully completed (to 3SF). (One mark for each column). If an expression is not given and all the data is totally correct then the last 2 marks are available. ECF data from incorrect expressions provided correctly calculated (and provided some attempt at a titration calculation is made). For incorrect expressions check calculate test data. Then the last 2 marks are available. If an expression is not given and all the data has been calculated correctly except it has not been divided by 2, then 1 mark is available.	[1] [2]
(b)	ACE Data	Give one mark for unambiguously labelling and scaling the x-axis and the y-axis provided the plotted points cover at least half the scalings in both directions. Plot may be either way round. Headings could be names or D or E Give one mark for correctly plotting the first, last and anomalous points and those that deviate significantly from the line (+/– ½ square except where a grid line is involved). All 10 data points must be plotted on the grid. ECF plots of incorrect data. Give one mark for drawing a 'line of best fit' which must pass through the origin (+/– ½).	[1] [1] [1]
(c)	ACE Data	The anomalies must be ringed and normally must include the two points furthest away from the drawn line on each side of the line (ignore other anomalies). If all the anomalies are on one side of the line – ring the furthest away (also ignore other anomalies). Accept only one anomaly if that is the situation where there is only one anomaly (the candidate may not have ringed all the anomalies). This mark negated if more than 5 anomalies. For each of the two different anomalies an appropriate explanation gains one mark. Explanations must be related to the particular point and include the nature of the deviation. Award 1 mark for two correct explanations not properly linked to a point.	[1] [2]

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Question	Sections	Indicative material	Mark
(d) (i)	ACE data	For appropriately drawn lines on the graph with correctly deduced intercepts (+/– ½ square except where a grid line is involved) give one mark.	[1]
(ii)		Correctly calculates the value of the gradient. This should be in the order of 16.3/0.061. ECF incorrect intercepts.	[1]
		Yes, Since the results produce a good linear/straight line graph, the procedure is OK. Normally a "no" answer is not acceptable. Do not accept an unjustified "yes" answer.	[1]
(e)	ACE Data	Any facilitation that takes the (succinic) acid into an aqueous phase will suffice e.g. to ensure that all the reactants are mixed in the aqueous layer / so the reactants are in solution in water for the neutralisation / makes the titration work because the acid is in the aqueous layer / extract or mix the acid into the aqueous phase to react / produce $H^+_{(aq)}$ to react with the alkali. Answers must have the acid in an aqueous phase.	[1]
(f)	ACE Data	Low (titre) values. Thus % errors are high (consequential). Percentage error is required.	[1] [1]
	Total		**[15]**

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