CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge Pre-U Certificate

MARK SCHEME for the May/June 2015 series

9791 CHEMISTRY

9791/04 Paper 4 (Practical), 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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1 (a)	I Records in a table the volume of **FA 1**, the volume of water and the reaction time for all five experiments.	[1]
	II Volumes given in cm^3, time in seconds	[1]
	III All volumes recorded to 0.05, all times recorded to nearest second	[1]
	IV Selects 3 additional volumes of **FA 1**, not less than 5.00 cm^3 and not closer together than 2.00 cm^3	[1]
	V All additional experiments have total volume of **FA 1** + water = 20.00 cm^3	[1]
	VI Award if candidate T_{20} / T_{10} lies within 15% of supervisor T_{20} / T_{10}.	[1]
	VII Award if candidate T_{20} / T_{10} lies within 10% of supervisor T_{20} / T_{10}.	[1]
	VIII Award if $1.8 \leqslant$ candidate T_{10} / $T_{20} \leqslant 2.2$	[1]
(b) (i)	Amount of $S_2O_3^{2-}$ = 1.5×10^{-3} mol	[1]
	Concentration of iodine = ½(1.5×10^{-3})/0.075 = 0.010 mol dm^{-3}	[1]
(ii)	Initial rates and initial concentrations correctly calculated for all five experiments.	[1]
(c)	I Initial rate on the *y-axis* with units of mol dm^{-3} s^{-1} and initial concentration on the *x-axis* with units of mol dm^{-3}	[1]
	II Scales chosen to use more than ½ of each axis	[1]
	III All five points plotted as fine cross or encircled dot to within ½ small square and within the correct square	[1]
	IV Best-fit straight line drawn	[1]
(d) (i)	First order as graph is a straight line through the origin.	[1]
(ii)	rate = k $[H_2O_2]$ $[I^-]$ $[H^+]$	[1]
(iii)	Correctly calculates the gradient from the graph.	[1]
(iv)	Correctly calculates the initial concentration of H_2O_2 as 0.0267 mol dm^{-3}.	[1]
	Correctly calculates k (gradient = k $[H_2O_2]$ $[H^+]$ k = gradient / (0.0267 × 0.276))	[1]
	Units of dm^6 mol^{-2} s^{-1}	[1]
(v)	HSO_4^- is a weak acid and its degree of dissociation depends on the concentration of H^+ present in solution.	[1]
(e)	Times would be shorter / rate is faster so less accurate.	[1]
		[Total: 23]

2	**FA 5 is $CuCO_3$ + $MnCl_2$**	
(a) (i)	Off-white ppt.	[1]
(ii)	Fizzing and positive test for CO_2.	[1]
	Blue solution formed.	[1]
	Blue ppt on adding NaOH .	[1]
(b)	The soluble salt contains Mn^{2+}. The insoluble salt contains Cu^{2+} and CO_3^{2-}. All three correct for two marks, two correct for one mark.	[2]
(c)	$AgNO_3$ / NH_3	[1]
	Notes problem of ppt with NH_3 because of the presence of Mn^{2+}. **ALLOW** answer which points out that you would need to filter off the silver halide ppt before testing with ammonia.	[1]
		[Total: 8]
3	**FA 6 is Na_2SO_3**	
(a) (i)	White ppt and soluble in excess.	[1]
(ii)	White ppt and insoluble in excess.	[1]
(iii)	Purple solution turns to pale yellow / brown **AND** gives a brown ppt.	[1]
	Solution turns colourless on adding acid / ppt dissolves.	[1]
(iv)	Acidified $KMnO_4$ paper turns colourless.	[1]
	Gas identified as SO_2.	[1]
(b)	SO_3^{2-}	[1]
(c)	Sulfite has changed to sulfate.	[1]
	Oxidation by H_2O_2.	[1]
		[Total: 9]