CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International Advanced Subsidiary and Advanced Level

MARK SCHEME for the March 2016 series

9701 CHEMISTRY

9701/52 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.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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question	expected answer	mark
1 (a)	**M1** (apparatus mark) volumetric flask in range 25–250 cm^3; **M2** mol propanone = 1.00 × (flask volume / 1000); e.g. mol of propanone = 1.00 × 25 / 1000 = 0.025 mol **M3** **M2** × 58.0; e.g.0.025 × 58.0 = 1.45 g	[3]
(b) (i)	**B** must be added before first or second reactant	[1]
(ii)	the reactants are **A** and **C** so one of these must be mixed last; **or** the reaction must not start before all three substances are present;	[1]
(c) (i)	(10 cm^3) pipette	[1]
(ii)	**M1** $NaHCO_3$ will effervesce so when effervescence finishes it shows that all H^+ ions have been removed; **M2** NaOH will react with I_2 / CH_3COCH_3 / reactants;	[2]
(d) (i)	**M1** mol I_2 = (10 / 100) × 0.200 × (50 / 1000) = 1.(00) × 10^{-3} mol; **M2** mol $S_2O_3^{2-}$ = 2 × 1.00 × 10^{-3} = 2.(00) × 10^{-3} mol; **M3** volume 0.100 mol dm^{-3} $S_2O_3^{2-}$ = (1000 × 2.00 × 10^{-3}) / 0.100 = 20(.0) cm^3;	[3]
(ii)	indicator = starch; colour change = blue-black to colourless;	[2]
(e)	time **and** units of s; volume of thiosulfate **and** units of cm^3;	[2]
(f)	temperature;	[1]
(g) (i)	**M1** (labels) *x*-axis = time *y*-axis = concentration of iodine **M2** curved line decreasing from left to right starting from *x* = 0	[2]

question	expected answer	mark
(ii)	idea of constant half-life: determine at least two half-lives from the graph and ensure that they are the same; **or** half-lives determined from the graph should be constant; **or** determine the gradient (rate) at different points on the graph and plot rate *v.* concentration to determine if the plot is linear and goes through the origin;	[1]
(h)	(incorrect and) half-life will still be constant; **or** temperature has no effect upon order (of reaction);	[1]
2 (a)	**M1** column amount of ethanol burned correctly completed **M2** column energy transferred to the water correctly completed	[2]

experiment number	amount of ethanol burned / mol	energy transferred to the water / kJ
1	0.00850	3.26
2	0.0106	3.95
3	0.0110	4.10
4	0.0122	4.50
5	0.0158	5.62
6	0.0130	5.20
7	0.00891	3.39
8	0.0148	5.30

question	expected answer	mark
(b)	**M1** at least eight correctly plotted points; **M2 c**orrect straight line;	[2]
(c)	experiment **6**;	[1]
(d)	**M1** co-ordinates, e.g. (0.0106, 3.95) and (0.0158, 5.62); **M2** gradient correctly calculated from points, e.g. 321 (kJ mol^{-1});	[2]
(e)	because the reaction is exothermic;	[1]
(f) (i)	((2 × 0.0005) / 0.391) × 100 = 0.256% **and** (0.05 / 40.0) × 100 = 0.125%;	[1]

question	expected answer	mark
(ii)	(total) errors in weighing do not account for the (large) error in enthalpy change determined; **or** heat loss (is more significant);	[1]