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**CHEMISTRY**

**9701/52**

Paper 5 Planning, Analysis and Evaluation

**October/November 2016**

MARK SCHEME

Maximum Mark: 30

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**Published**

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.

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<b>Page 2</b>	<b>Mark Scheme</b>	<b>Syllabus</b>	<b>Paper</b>
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<b>Question</b>	<b>Expected answer</b>	<b>Marks</b>
1(a)	the reaction produces (more) H <sup>+</sup> ions	<b>1</b>
1(b)(i)	<p>volumetric flask      250 cm<sup>3</sup></p> <p>pipette                    25 cm<sup>3</sup></p> <p>burette                    50 cm<sup>3</sup></p> <p>3 correct pieces and volumes = 2 marks 2 correct pieces and volumes = 1 mark</p>	<b>2</b>
1(b)(ii)	$372.2 \times 0.100 \times$ volumetric flask volume from <b>(i)</b> / 1000	<b>1</b>
1(b)(iii)	<p>Dissolve / stir / mix (answer to <b>1(b)(ii)</b>) / all of hydrated salt in (a container with) (distilled water)</p> <p>(Transfer / add to a) volumetric flask (of size given in <b>1(b)(i)</b> or allowed in <b>1(b)(ii)</b>), make to mark (or volume used for volumetric flask) (with distilled water)</p> <p>NOTE: Water must be mentioned at least once for one mark to be awarded. Distilled/deionised/purified water must be mentioned for 2 marks to be awarded.</p>	<p>1</p> <p>1</p> <p><b>2</b></p>
1(b)(iv)	Add solution dropwise (close to the endpoint)	<b>1</b>
1(b)(v)	experiment / titration is repeated to get concordant titres	<b>1</b>

<b>Page 3</b>	<b>Mark Scheme</b>	<b>Syllabus</b>	<b>Paper</b>
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<b>Question</b>	<b>Expected answer</b>	<b>Marks</b>
1(c)(i)	<p>(NaOH(aq) is) corrosive  <b>and</b>  Wear gloves  <b>OR</b></p> <p>(Solochrome black solution or ethanol is) flammable  <b>and</b>  Keep away from naked flames  <b>OR</b></p> <p>(Solochrome black solution) is (health hazard) in context of:  Irritating to respiratory system  <b>and</b>  Fume cupboard <b>OR</b> Face mask <b>OR</b> Nose mask <b>OR</b> Mouth mask <b>OR</b> Breathing mask  <b>OR</b></p> <p>Irritating to skin  <b>and</b>  Gloves</p>	<b>1</b>

<b>Page 4</b>	<b>Mark Scheme</b>	<b>Syllabus</b>	<b>Paper</b>
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<b>Question</b>	<b>Expected answer</b>	<b>Marks</b>
1(c)(ii)	<p>concentration of <math>\text{Ca}^{2+} = 6.64 \times 10^{-3} \text{ mol dm}^{-3}</math>  concentration of <math>\text{Mg}^{2+} = 2.44 \times 10^{-3} \text{ mol dm}^{-3}</math></p> <p><b>OR</b></p> <p>subtraction of <math>\text{Ca}^{2+}</math> value from total value, either <math>\text{cm}^3</math> or calculated moles</p> <p>2 x calculations for 'no of mol' of edta reacting in the titration</p> <p>use of <math>\text{M}^{2+}</math> ion 1 : 1 edta stoichiometry</p> <p><b>two</b> conversions of moles to concentrations in <math>\text{mol dm}^{-3}</math></p>	<p><b>4</b></p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>
	<b>Total</b>	<b>13</b>

Page 5	Mark Scheme	Syllabus	Paper
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Question	Expected answer	Marks												
2(a)(i)	<table border="1"> <tr><td><math>(V_f - V)</math></td></tr> <tr><td>252</td></tr> <tr><td>220</td></tr> <tr><td>190</td></tr> <tr><td>165</td></tr> <tr><td>142</td></tr> <tr><td>123</td></tr> <tr><td>106</td></tr> <tr><td>92</td></tr> <tr><td>79</td></tr> <tr><td>68</td></tr> <tr><td>59</td></tr> </table>	$(V_f - V)$	252	220	190	165	142	123	106	92	79	68	59	1
$(V_f - V)$														
252														
220														
190														
165														
142														
123														
106														
92														
79														
68														
59														
2(a)(ii)	<p>all eleven points plotted correctly</p> <p>best-fit <b>curved</b> line drawn</p>	<p>1</p> <p>1</p> <p><b>2</b></p>												

Page 6	Mark Scheme	Syllabus	Paper
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Question	Expected answer	Marks
2(a)(iii)	(Yes), the data is reliable because most of the points are on the line <b>OR</b> only a few points are not on the line.	1
2(a)(iv)	two co-ordinates on line correctly read and stated <b>AND</b> one y value must be half the other  $t_{\frac{1}{2}}$ correctly determined from candidate's values	1   1 <b>2</b>
2(b)(i)	use of labelled gas syringe <b>OR</b> collection over water using inverted labelled 'measuring cylinder' etc  apparatus will work (must be closed system)	1  1 <b>2</b>
2(b)(ii)	(Increased rate of reaction) means harder to read syringe / measuring cylinder / volume / values (at precise time) <b>OR</b> Gas given off is (initially) hot (then cools) <b>AND</b> Volume will be greater  ( $V_{\text{final}} - V$ ) will be lower (at the same time value)	1     1 <b>2</b>
2(c)(i)	Reading was taken too late	1

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<b>Question</b>	<b>Expected answer</b>	<b>Marks</b>
2(c)(ii)	<p>draws tangent at <math>t = 200</math> s</p> <p>both sets of co-ordinates read and recorded correctly</p> <p>correctly calculated values of the gradient given to minimum of 2 sf and using the candidate's figures</p> <p><math>(V_{\text{final}} - V)</math> at 200s = <math>158 \pm 1</math> (<math>\text{cm}^3 \text{s}^{-1}</math>)</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p><b>4</b></p>
2(c)(iii)	<p>reaction is first order with respect to benzenediazonium chloride</p> <p>candidate uses numerical data in the table to prove order stated e.g. Demonstrates that as <math>(V_{\text{final}} - V)</math> doubles rate doubles</p> <p><b>OR</b></p> <p>Demonstrates that as <math>(V_{\text{final}} - V)</math> doubles, time halves</p>	<p>1</p> <p>1</p> <p><b>2</b></p>
		<b>Total: 17</b>