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**CHEMISTRY**

**9701/53**

Paper 5 Planning, Analysis and Evaluation

**October/November 2016**

MARK SCHEME

Maximum Mark: 30

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**Published**

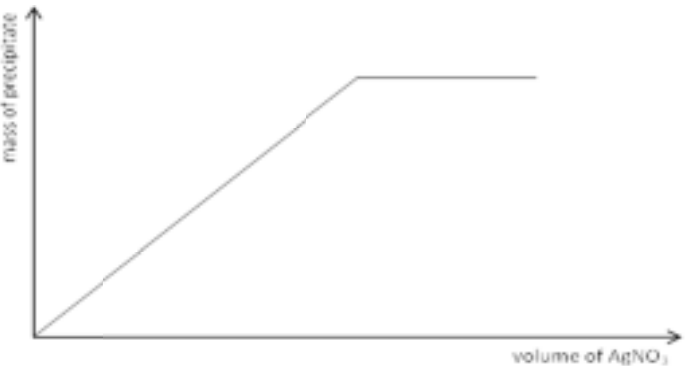
This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, 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.

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Page 2	Mark Scheme	Syllabus	Paper
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Question	Answer	Mark
1(a)(i)	silver chromate(VI)/silver chromate $2\text{Ag}^+ + \text{CrO}_4^{2-} \rightarrow \text{Ag}_2\text{CrO}_4$ OR $2\text{Ag}^+ + \text{K}_2\text{CrO}_4 \rightarrow \text{Ag}_2\text{CrO}_4 + 2\text{K}^+$ OR $2\text{AgNO}_3 + \text{K}_2\text{CrO}_4 \rightarrow \text{Ag}_2\text{CrO}_4 + 2\text{KNO}_3$	1 1 <b>2</b>
1(a)(ii)	insoluble / solid barium chromate(VI) / barium chromate would form	1 <b>1</b>
1(a)(iii)	insoluble / solid barium sulfate is formed	1 <b>1</b>
1(b)	 <p>correctly labelled axes  straight line through origin <b>AND</b> reaches a plateau</p>	1 1 <b>2</b>
1(c)(i)	Volumetric/graduated flask    250 cm <sup>3</sup> pipette (graduated)            25 cm <sup>3</sup> burette                                50 cm <sup>3</sup>	<b>2</b>

<b>Page 3</b>	<b>Mark Scheme</b>	<b>Syllabus</b>	<b>Paper</b>
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<b>Question</b>	<b>Answer</b>	<b>Mark</b>
1(c)(ii)	Dissolve / stir / mix known mass / all of hydrated salt in (a container with) (distilled water)  (Transfer / add to a) volumetric flask, make to mark (with distilled water) or to the volume of the stated volumetric flask (in <b>1(c)(i)</b> or <b>1(c)(ii)</b> )  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.	1  1  <b>2</b>
1(c)(iii)	first = sulfuric acid second = potassium chromate(VI) third = silver nitrate	1  <b>1</b>
1(c)(iv)	experiment / titration is repeated to get concordant titre	1  <b>1</b>
1(c)(v)	$0.0128 \times 208.3 = 2.67 \text{ g of BaCl}_2$ <b>AND</b> $3.13 - 2.67 = 0.46 \text{ g of H}_2\text{O}$  $x = (0.46 / 18.0) \div 0.0128 = 2$	1  1  <b>2</b>

<b>Page 4</b>	<b>Mark Scheme</b>	<b>Syllabus</b>	<b>Paper</b>
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<b>Question</b>	<b>Answer</b>	<b>Mark</b>
1(d)	<p>Potassium chromate (solution) – (health hazard in context of) respiratory irritation  <b>AND</b>  fume cupboard / face / nose / mouth mask  .....</p> <p><b>OR</b>  Potassium chromate – (health hazard in context of) skin irritation  <b>AND</b>  (chemical resistant) gloves  .....</p> <p><b>OR</b>  barium chloride (solid) as toxic  <b>AND</b>  (chemical resistant) gloves / large dilution on disposal  .....</p> <p><b>OR</b>  Sulfuric acid as irritant / skin irritant  <b>AND</b>  (chemical resistant) gloves</p>	<p>1</p> <p><b>1</b></p>
	<b>Total:</b>	<b>15</b>

<b>Page 5</b>	<b>Mark Scheme</b>	<b>Syllabus</b>	<b>Paper</b>
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<b>Question</b>	<b>Answer</b>	<b>Mark</b>																																				
2(a)	<p>Column <b>C</b> data correct            Column <b>D</b> data correct and given to 2 dp</p> <table border="1"> <thead> <tr> <th><b>C</b></th> <th><b>D</b></th> <th></th> </tr> </thead> <tbody> <tr> <td><math>(\alpha - \alpha_{\infty})</math></td> <td><math>\log_{10}(\alpha - \alpha_{\infty})</math></td> <td>time</td> </tr> <tr> <td>51.9</td> <td>1.72</td> <td>0</td> </tr> <tr> <td>41.1</td> <td>1.61</td> <td>300</td> </tr> <tr> <td>33.3</td> <td>1.52</td> <td>600</td> </tr> <tr> <td>27.5</td> <td>1.44</td> <td>900</td> </tr> <tr> <td>22.6</td> <td>1.35</td> <td>1200</td> </tr> <tr> <td>18.2</td> <td>1.26</td> <td>1500</td> </tr> <tr> <td>14.4</td> <td>1.16</td> <td>1800</td> </tr> <tr> <td>11.7</td> <td>1.07</td> <td>2100</td> </tr> <tr> <td>9.5</td> <td>0.98</td> <td>2400</td> </tr> <tr> <td>7.5</td> <td>0.88</td> <td>2700</td> </tr> </tbody> </table>	<b>C</b>	<b>D</b>		$(\alpha - \alpha_{\infty})$	$\log_{10}(\alpha - \alpha_{\infty})$	time	51.9	1.72	0	41.1	1.61	300	33.3	1.52	600	27.5	1.44	900	22.6	1.35	1200	18.2	1.26	1500	14.4	1.16	1800	11.7	1.07	2100	9.5	0.98	2400	7.5	0.88	2700	<p>1            1    <b>2</b></p>
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Page 6	Mark Scheme	Syllabus	Paper
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Question	Answer	Mark
2(b)(i)	All ten points plotted correctly Best-fit <b>straight</b> line drawn	1 1 <b>2</b>
2(b)(ii)	(Yes) most of the points are on the line <b>OR</b> only a few points are not on the line	1 <b>1</b>
2(c)(i)	Co-ordinates read and recorded correctly  Correctly calculated value of the gradient given to <b>3sf</b> and using the candidate's co-ordinates correctly	1 1 <b>2</b>
2(c)(ii)	$k = \text{candidate's gradient} \times (-2.30)$ Correct answer	1 1 <b>2</b>
2(d)(i)	Reading / value of $\alpha$ was read / taken / recorded too early	1 <b>1</b>
2(d)(ii)	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 co-ordinates values provided $y_1 = y_2/2$	1  1 <b>2</b>
2(d)(iii)	Correctly calculated value for $k' = \frac{0.693}{t_{\frac{1}{2}}}$	1 <b>1</b>

<b>Page 7</b>	<b>Mark Scheme</b>	<b>Syllabus</b>	<b>Paper</b>
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<b>Question</b>	<b>Answer</b>	<b>Mark</b>	
2(d)(iv)	Second reaction took place at <u>higher</u> temperature <b>AND</b> because $k'$ (second $k$ value) is larger	1	<b>1</b>
2(d)(v)	No <b>OR</b> the half-life would not change <b>AND</b> half-life is independent of concentration <b>OR</b> the reaction is first order (with respect to sucrose)	1	<b>1</b>
		<b>Total:</b>	<b>15</b>