
CHEMISTRY

9701/05

Paper 5 Planning, Analysis and Evaluation

For Examination from 2016

SPECIMEN MARK SCHEME

1 hour 15 minutes

MAXIMUM MARK: 30

This document consists of **5** printed pages and **1** blank page.

Question	Expected Answer	Additional Guidance	Mark
1 (a) (i)	The temperature		1
	The surface area of the marble chips	Allow size of the marble chips	1
	(ii) Measure the temperature of the hydrochloric acid AND Use the same mass and number of marble chips		1
(iii)	The mass of the carbon dioxide	Allow loss in mass of the flask containing the reactants	1
(b)	The diagram shows a container for the marble chips and hydrochloric acid connected to a gas syringe.	Allow collection of carbon dioxide over water	1
	All connections are shown such that the apparatus would work without leakage of carbon dioxide.	Bungs/corks must be shown where required	1
	The apparatus is fully labelled.		1
(c)	The volume of hydrochloric acid The concentration of the hydrochloric acid The mass of marble chips The time taken to collect 100 cm ³ of carbon dioxide	Ignore mention of temperature or size of marble chips Allow final time or time to end of experiment	
	4 correct 2 marks 3 correct 1 mark		1 1
(d)	Stated volume of 2.00 mol dm ⁻³ hydrochloric acid is taken using a pipette/burette and placed in a volumetric flask	Do not allow the use of a measuring cylinder	1
	Water added to the volumetric flask to make up to the mark AND solution then shaken/flask is inverted several times		1
	The volume of the volumetric flask is four times the volume of hydrochloric acid taken OR the volume of water added is three times the volume of hydrochloric acid taken	Volumetric flask must be a conventional size (i.e. allow 25, 50, 100, 150, 200, 250, 500, 1000 or 2000 cm ³)	1
(e)	The concentration of the acid must be such that it is the acid and not the marble chips which is controlling the rate of reaction	Allow any wording of the answer which shows an understanding of this point	1

Question	Expected Answer	Additional Guidance	Mark
(f)	The concentration of the hydrochloric acid		1
	The inverse of the time taken	Do not allow 'rate' unless this is stated as 1/t	1
Qn 1		Total	15

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2 (a)	<table border="1" data-bbox="324 199 985 965"> <thead> <tr> <th data-bbox="324 199 660 247">E</th> <th data-bbox="660 199 985 247">F</th> </tr> <tr> <th data-bbox="324 247 660 343">Mass of X_2CO_3 /g A – B</th> <th data-bbox="660 247 985 343">Mass of CO_2 /g C + E – D</th> </tr> </thead> <tbody> <tr><td>2.81</td><td>0.95</td></tr> <tr><td>4.65</td><td>1.45</td></tr> <tr><td>0.90</td><td>0.38</td></tr> <tr><td>5.50</td><td>2.08</td></tr> <tr><td>5.80</td><td>1.84</td></tr> <tr><td>3.70</td><td>1.20</td></tr> <tr><td>2.20</td><td>0.56</td></tr> <tr><td>7.40</td><td>2.15</td></tr> <tr><td>5.24</td><td>1.70</td></tr> <tr><td>6.40</td><td>2.05</td></tr> <tr><td>3.40</td><td>0.90</td></tr> <tr><td>7.32</td><td>2.34</td></tr> </tbody> </table> <p data-bbox="324 997 896 1029">Correct formulae and units for table heading</p> <p data-bbox="324 1061 739 1093">All values to two decimal places</p> <p data-bbox="324 1125 548 1157">All values correct</p>	E	F	Mass of X_2CO_3 /g A – B	Mass of CO_2 /g C + E – D	2.81	0.95	4.65	1.45	0.90	0.38	5.50	2.08	5.80	1.84	3.70	1.20	2.20	0.56	7.40	2.15	5.24	1.70	6.40	2.05	3.40	0.90	7.32	2.34		<p data-bbox="2004 997 2027 1029">1</p> <p data-bbox="2004 1061 2027 1093">1</p> <p data-bbox="2004 1125 2027 1157">1</p>
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(b)	<p data-bbox="324 1189 660 1220">All points plotted correctly</p> <p data-bbox="324 1252 1153 1356">Appropriate straight line of best fit drawn (The deviation of points on each side of the best fit line must be nearly the same)</p>	<p data-bbox="1187 1252 1892 1356">It is not a requirement that the best fit line extends beyond the range of the data obtained but if the line of best fit is extended it should pass through the origin.</p>	<p data-bbox="2004 1189 2027 1220">1</p> <p data-bbox="2004 1324 2027 1356">1</p>																												

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(c)	<p>The anomalous point chosen must be more than two small squares distant from the line of best fit.</p> <p>If the point identified indicates too much CO₂ produced then this could be because the cotton wool plug was not weighed at the end OR If the point identified indicates too little CO₂ produced then this could be that the solution was not saturated with CO₂ at the start/CO₂ not left long enough to diffuse</p>		1
(d)	Identifies less reliability with lower masses of X ₂ CO ₃ because percentage errors will be higher	Allow any wording of the answer which shows an understanding of this point	1
(e) (i)	<p>Marks on the graph and gives correct co-ordinates for two points which lie on the line of best fit</p> <p>Calculates the gradient correctly using the two points</p>	No mark should be awarded if units are given for the gradient	1 1
(ii)	<p>Explains that the gradient is the mass of CO₂ divided by the mass of X₂CO₃</p> <p>Calculates correctly M_r of X₂CO₃ as 44/gradient</p>		1 1
(f) (i)	No change as the mass is unaffected by a change in temperature		1
(ii)	<p>Line would have a steeper gradient</p> <p>An equivalent mass of Y₂CO₃ produces more CO₂ OR an equivalent volume of CO₂ is produced by a smaller mass of Y₂CO₃</p>		1 1
(g)	Use a titration of X ₂ CO ₃ against HCl	Allow other named strong acid	1
Qn2		Total	15

