

CHEMISTRY**9701/52**

Paper 5 Planning, Analysis and Evaluation

May/June 2016

MARK SCHEME

Maximum Mark: 30

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
	Cambridge International AS/A Level – May/June 2016	9701	52

Question	Expected answer	Mark
1 (a)	(As the E°_{cell} value increases) ΔH_r decreases or ΔH_r becomes more negative or ΔH_r becomes more exothermic. AND The more reactive the metal then the greater the energy release will be. OR Energy output of both reactions is dependent upon the difference in reactivity (of metals).	[1]
(b)	Independent variable: The (type of) metal Dependent variable: temperature change or rise or increase OR enthalpy change	[1] [1]
(c) (i)	Diagram should indicate a labelled insulated container AND a labelled thermometer in the liquid.	[1]
(ii)	Mass of metal before and after Initial temperature (before metal added) AND Highest temperature (after metal added)	[1] [1]
(iii)	Wear gloves	[1]
(iv)	Moles $\text{CuSO}_4 = 0.025 \text{ mol}$, therefore moles of magnesium = 0.025 mol (minimum) mass $\text{Mg} > (0.025 \times 24.3 =) 0.6075 \text{ g}$ AND mass required value is greater than 0.6075 g	[1] [1]
(v)	Larger surface area AND causes increased rate of reaction	[1]
(vi)	Ensure uniformity of heating (of solution)	[1]

Page 3	Mark Scheme	Syllabus	Paper
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Question	Expected answer	Mark
(d)	$50.0 \times 4.18 \times 58.5 = 12\,226.5 \text{ (J)}$	[1]
	$\Delta H_r = 12\,226.5 / 0.025 = \frac{489\,000}{1000} = -489$	[1]
(e)	Complete circuit involving labelled voltmeter; labelled salt bridge; two separate solutions;	[1]
	(Solutions are) magnesium sulfate or MgSO_4 with magnesium or Mg rod and copper(II) sulfate CuSO_4 with copper or Cu rod	[1]
	Concentration of solution(s) is 1 mol dm^{-3} or 1 M	[1]
(f)	So that values can be compared	[1]
(g)	Both ΔH_r (Zn) and ΔH_r (Fe) values which are consistent with the prediction in (a) .	[1]
		[18]

Page 4	Mark Scheme	Syllabus	Paper
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Question	Expected answer	Mark																						
2 (a)	<table border="1"> <thead> <tr> <th>Mass of liquid Y used /g</th> <th>Volume of vapour Y /cm³</th> </tr> </thead> <tbody> <tr><td>0.15</td><td>48</td></tr> <tr><td>0.10</td><td>35</td></tr> <tr><td>0.21</td><td>72</td></tr> <tr><td>0.17</td><td>58</td></tr> <tr><td>0.24</td><td>83</td></tr> <tr><td>0.09</td><td>31</td></tr> <tr><td>0.20</td><td>70</td></tr> <tr><td>0.23</td><td>79</td></tr> <tr><td>0.12</td><td>41</td></tr> <tr><td>0.22</td><td>73</td></tr> </tbody> </table> <p>All mass values.</p> <p>All volume values.</p>	Mass of liquid Y used /g	Volume of vapour Y /cm ³	0.15	48	0.10	35	0.21	72	0.17	58	0.24	83	0.09	31	0.20	70	0.23	79	0.12	41	0.22	73	[1] [1]
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(b)	Candidate's points plotted correctly from table in 2(a).	[1]																						
	Line of best fit drawn.	[1]																						

Page 5	Mark Scheme	Syllabus	Paper
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Question	Expected answer	Mark
(c) (i)	Y evaporates from the (hypodermic) syringe OR Y evaporates before injection OR Y evaporates before weighing / after injection	[1]
(ii)	(Stop evaporation by) Keeping the syringe as cool as possible OR Closing off the needle end to stop evaporation OR Minimising length of time between each weighing	[1]
(d) (i)	correct co-ordinates. correct calculation of the gradient must be three significant figures	[1] [1]
(ii)	Calculation of $M_r = 3.07 \times 10^4 / \text{gradient in 2(d)(i)}$ Answer	[1] [1]
(e)	M_r (from mass spectrum) = 84 OR empirical formula = CH_2 OR ratio of C and H seen as 1:2 Y is C_6H_{12}	[1] [1]
		[12]