Cambridge International AS & A Level

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CHEMISTRY **9701/52**

Paper 5 Planning, Analysis and Evaluation **May/June 2016**

MARK SCHEME

Maximum Mark: 30

Published

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Question	Expected answer	Mark
1 (a)	(As the $E^{\ominus}_{cell}$ 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 $CuSO_4$ = 0.025 mol, therefore moles of magnesium = 0.025 mol (minimum) mass Mg > (0.025 × 24.3 =) 0.6075 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]

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Question	Expected answer	Mark
(d)	$50.0 \times 4.18 \times 58.5 = 12\,226.5$ (J) $\Delta H_r = 12\,226.5 / 0.025 = \frac{489\,000}{1000} = -489$	[1] [1]
(e)	Complete circuit involving labelled voltmeter; labelled salt bridge; two separate solutions; (Solutions are) magnesium sulfate or $MgSO_4$ with magnesium or Mg rod and copper(II) sulfate $CuSO_4$ with copper or Cu rod Concentration of solution(s) is 1 mol dm^{-3} or 1 M	[1] [1] [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]

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<table>
<tr><th>Question</th><th>Expected answer</th><th>Mark</th></tr>
<tr><td>2 (a)</td><td>
<table>
<tr><th>Mass of liquid Y used / g</th><th>Volume of vapour Y / cm^3</th></tr>
<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>
</table>
All mass values.
All volume values.
</td><td>[1]
[1]</td></tr>
<tr><td>(b)</td><td>Candidate’s points plotted correctly from table in 2(a).
Line of best fit drawn.</td><td>[1]
[1]</td></tr>
</table>

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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 $M_r = 3.07 \times 10^4$ / 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]

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