Cambridge International AS & A Level

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CHEMISTRY **9701/51**

Paper 5 Planning, Analysis and Evaluation **October/November 2017**

MARK SCHEME

Maximum Mark: 30

Published

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Question	Answer	Marks
1(a)(i)	mass = 228.2 × 1.00 × (250 / 1000) = 57.1 g	**1**
1(a)(ii)	**Distilled/deionised water must be mentioned somewhere for 2 marks to be given.** Dissolve (all) the solid in a (suitable container) with (distilled) water	**1**
	Transfer / add to a 250 cm^3 volumetric flask **AND** make to mark with (distilled) water	**1**
1(a)(iii)	(starch) gives a sharp 'end-point' / turns blue sharply / goes blue with volume of I_2 invisible to naked eye	**1**
1(b)	volumes of $(NH_4)_2S_2O_8$(aq) constant	**1**
	volumes of I^- varying with range	**1**
	total volume constant, made up by water	**1**
1(c)(i)	mol I_2(aq) = $V(S_2O_3^{2-}) \times [S_2O_3^{2-}] / 2$ $= \left(\frac{0.005 \times 0.0050}{2}\right)$ $= 1.25 \times 10^{-5}$	**1**
	$[I_2(aq)] = \frac{\text{moles of } I_2(aq)}{V_{total}} = \frac{1.25 \times 10^{-5}}{0.021} = 5.95 \times 10^{-4}$	**1**
	rate = $[I_2(aq)]$ / time $= \frac{5.95 \times 10^{-4}}{134}$ $= 4.44 \times 10^{-6}$	**1**
1(c)(ii)	repeat the experiment (and take average)	**1**
1(c)(iii)	% error= $\frac{2 \times 0.05}{5.0} \times 100\% = 2(.0)\ \%$	**1**

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Question	Answer	Marks
1(d)	No thiosulfate had been added	**1**
1(e)	Ammonium persulfate must be stated along with its hazard **and** linked to the precaution. Ammonium persulfate is a skin irritant so wear gloves OR Ammonium persulfate is an irritant to the respiratory system; do the experiment in fume cupboard / face mask OR Ammonium persulfate is harmful if swallowed so avoid mouth contact / wear face mask OR Ammonium persulfate is oxidising so avoid contact with flammable / combustible materials. OR Ammonium persulfate is harmful / hazardous to the environment so do not dispose of down the drain / use (large quantities) of water to dilute before disposal	**1**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(a)</td><td>
<table>
<tr><th>time / s</th><th>burette reading / cm^3</th><th>volume (of hydrogen) / cm^3</th><th>charge / C</th></tr>
<tr><td>0</td><td>46.20</td><td>0.00</td><td>0</td></tr>
<tr><td>50</td><td>41.20</td><td>5.00</td><td>40</td></tr>
<tr><td>100</td><td>36.20</td><td>10.00</td><td>80</td></tr>
<tr><td>150</td><td>31.45</td><td>14.75</td><td>120</td></tr>
<tr><td>200</td><td>25.80</td><td>20.40</td><td>160</td></tr>
<tr><td>250</td><td>20.80</td><td>25.40</td><td>200</td></tr>
<tr><td>300</td><td>16.40</td><td>29.80</td><td>240</td></tr>
<tr><td>350</td><td>11.45</td><td>34.75</td><td>280</td></tr>
<tr><td>400</td><td>6.80</td><td>39.40</td><td>320</td></tr>
<tr><td>450</td><td>1.50</td><td>44.70</td><td>360</td></tr>
</table>
volumes of hydrogen correct to 2 d.p.
charge correct</td><td>2</td></tr>
<tr><td>2(b)</td><td>All ten points plotted correctly</td><td>1</td></tr>
<tr><td></td><td>Best-fit straight line drawn</td><td>1</td></tr>
<tr><td>2(c)</td><td>Yes, (the data is reliable because) most of the points are on the line OR only a few points are not on the line.</td><td>1</td></tr>
<tr><td>2(d)(i)</td><td>co-ordinates read and recorded correctly</td><td>1</td></tr>
<tr><td></td><td>gradient determined</td><td>1</td></tr>
<tr><td>2(d)(ii)</td><td>= (i) ÷ 24000</td><td>1</td></tr>
<tr><td>2(d)(iii)</td><td>= 1 ÷ (2 × (ii))</td><td>1</td></tr>
</table>

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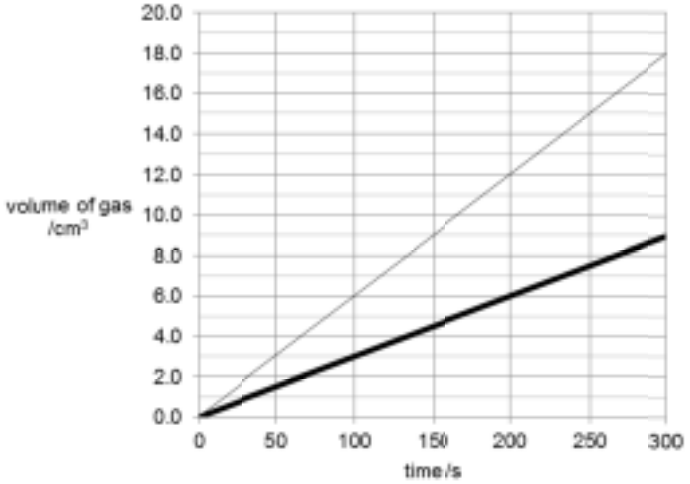
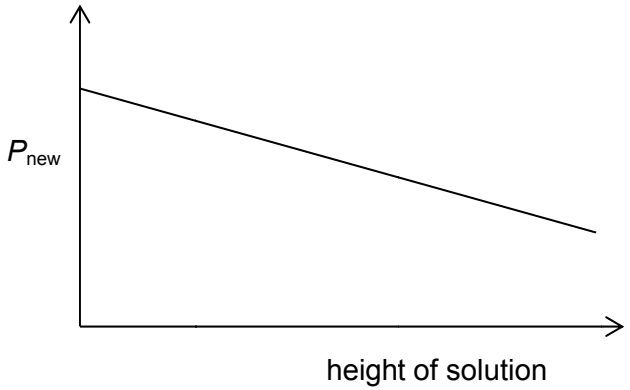
Question	Answer	Marks
2(e)(i)	 straight line from origin to (300, 9.0)	**1**
2(e)(ii)	Oxygen is (slightly) soluble in water	**1**
2(f)(i)	 straight line with negative gradient	**1**
2(f)(ii)	Faraday constant will be <u>lower</u> (than calculated) because the volume / V_m larger	**1**

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Question	Answer	Marks
2(g)	No effect at cathode	**1**
	Less gas produced at anode	**1**
	Copper anode will dissolve / is (an) active (anode) **OR** copper has lower / more negative $E^{\ominus}$	**1**

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