Cambridge International AS & A Level

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**CHEMISTRY** **9701/53**

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)<br>= 57.1 g | **1** |
| 1(a)(ii) | **Distilled/deionised water must be mentioned somewhere for 2 marks to be given.**<br>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) = $V(S_2O_3^{2-}) \times [S_2O_3^{2-}] / 2$<br>$= \left(\frac{0.005 \times 0.0050}{2}\right)$ $= 1.25 \times 10^{-5}$ | **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<br>$= \frac{5.95 \times 10^{-4}}{134}$ $= 4.44 \times 10^{-6}$ | **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** |

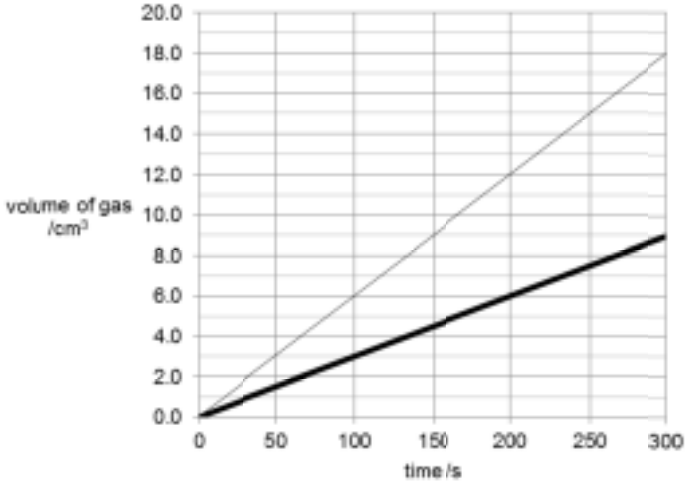
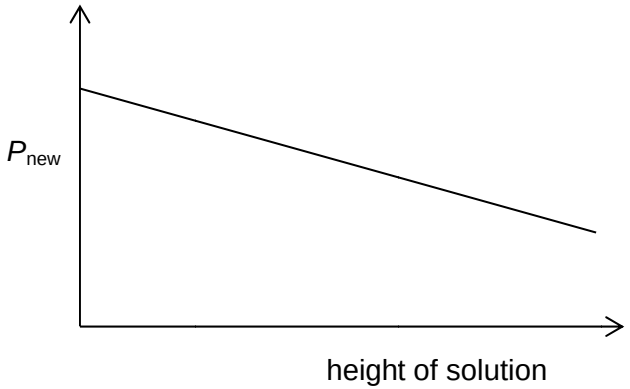
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| Question | Answer | Marks |
|---|---|---|
| 1(d) | No thiosulfate had been added | **1** |
| 1(e) | Ammonium persulfate must be stated along with its hazard **and** linked to the precaution.<br><br>Ammonium persulfate is a skin irritant so wear gloves<br>OR<br>Ammonium persulfate is an irritant to the respiratory system; do the experiment in fume cupboard / face mask<br><br>OR<br>Ammonium persulfate is harmful if swallowed so avoid mouth contact / wear face mask<br><br>OR<br>Ammonium persulfate is oxidising so avoid contact with flammable / combustible materials.<br><br>OR<br>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.<br>charge correct</td><td>2</td></tr>
<tr><td rowspan="2">2(b)</td><td>All ten points plotted correctly</td><td>1</td></tr>
<tr><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 rowspan="2">2(d)(i)</td><td>co-ordinates read and recorded correctly</td><td>1</td></tr>
<tr><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) | <br>straight line from origin to (300, 9.0) | **1** |
| 2(e)(ii) | Oxygen is (slightly) soluble in water | **1** |
| 2(f)(i) | <br>straight line with negative gradient | **1** |
| 2(f)(ii) | Faraday constant will be <u>lower</u> (than calculated)<br>because the volume / $V_m$ larger | **1** |

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