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

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.

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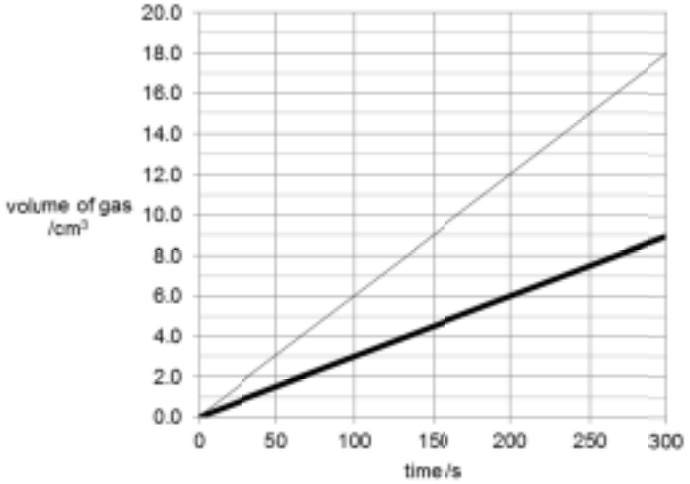
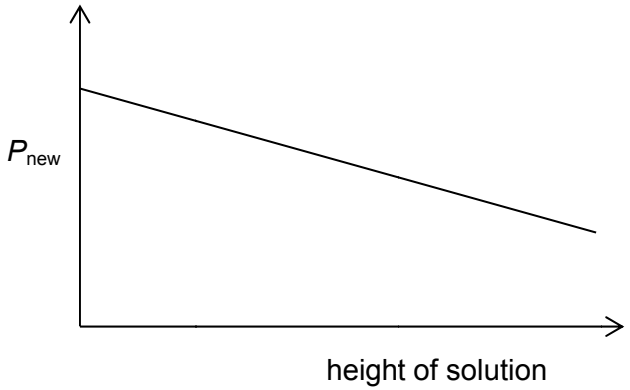
Question	Answer	Marks
1(a)(i)	mass = 228.2 × 1.00 × (250 / 1000) = 57.1 g	**1**
1(a)(ii)	**Distilled/deionised water must be mentioned somewhere for 2 marks to be given.** Dissolve (all) the solid in a (suitable container) with (distilled) water	**1**
	Transfer / add to a 250 cm^3 volumetric flask **AND** 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**

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**

Question	Answer	Marks
2(a)	<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	**2**
2(b)	All ten points plotted correctly	**1**
	Best-fit straight line drawn	**1**
2(c)	Yes, (the data is reliable because) most of the points are on the line **OR** only a few points are not on the line.	**1**
2(d)(i)	co-ordinates read and recorded correctly	**1**
	gradient determined	**1**
2(d)(ii)	= **(i)** ÷ 24000	**1**
2(d)(iii)	= 1 ÷ (2 × **(ii)**)	**1**

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

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**