
CHEMISTRY

9701/51

Paper 5 Planning, Analysis and Evaluation

May/June 2019

MARK SCHEME

Maximum Mark: 30

Published

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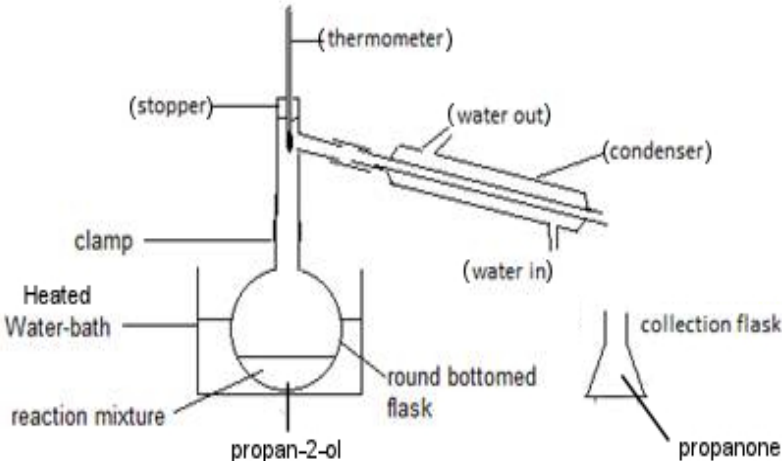
Question	Answer	Marks
1(a)	P = Voltmeter Q = Salt bridge Conc = 1(.00) mol dm ⁻³	1
1(b)(i)	100 / 1000 × 0.200 = 0.020 moles Volume of 0.500 mol dm ⁻³ = 0.020/0.500 = 40(.0) cm ³	1
1(b)(ii)	M1 Transfer 40.0 cm ³ of 0.500 mol dm ⁻³ solution into a (100.0 cm ³) volumetric flask using a burette	1
	M2 Make up to the <u>mark / line</u> with distilled water. (Stopper and shake).	1

Question	Answer				Marks
1(b)(iii)		$[\text{Mn}^{2+}]$ / mol dm^{-3}	Cell Potential / V	Log $[\text{Mn}^{2+}]$	Electrode potential (manganese half-cell), E / V
		5.0×10^{-1}	+1.529	−0.30	−1.189
		2.0×10^{-1}	+1.541	−0.70	−1.201
		1.0×10^{-1}	+1.550	−1.00	−1.210
		7.5×10^{-2}	+1.553	−1.12	−1.213
		2.5×10^{-2}	+1.567	−1.60	−1.227
		8.0×10^{-3}	+1.582	−2.10	−1.242
		6.0×10^{-3}	+1.590	−2.22	−1.250
		4.0×10^{-3}	+1.591	−2.40	−1.251
		3.0×10^{-3}	+1.594	−2.52	−1.254
		5.0×10^{-4}	+1.617	−3.30	−1.277
	1 mark for each correct column				2

Question	Answer	Marks
1(c)	M1 Correctly plotted data points	1
	M2 Accurate line of best fit	1
1(d)(i)	Ring around point at $-2.22, -1.250$	1
1(d)(ii)	(The point is below the line) The solution is more dilute than it should be.	1

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Question	Answer	Marks
1(e)	−1.18v	1
1(f)(i)	M1 Points read from the graph	1
	M2 Gradient calculated correctly	1
1(f)(ii)	M1 Gradient = $0.059 / z$ $z = 0.059 / \text{gradient}$ $0.059 / 0.0293 = 2.01$	1
	M2 Mn ²⁺	1
1(g)	The equilibrium between the metal and its ions moves to produce more Mn ²⁺ or electrons / more reaction $\text{Mn} \rightarrow \text{Mn}^{2+} + 2\text{e}^-$ / the tendency to ionise / oxidise increases.	1

Question	Answer	Marks
2(a)(i)	M1 M_r propan-2-ol is $36 + 16 + 8 = 60$ and n propan-2-ol = $5 / 60 = 0.0833(3)$	1
	M2 n $K_2Cr_2O_7 = 0.0833 \div 3 = 0.0278$ M_r $K_2Cr_2O_7 = 78.2 + 104 + 112 = 294.2$ Mass = $294.2 \times 0.0278 = 8.16953333 = 8.17$ g	1
2(a)(ii)	 Marks awarded for correctly labelled diagram showing the following: • Thermometer in the correct position • Condenser showing coolant • Sealed apparatus around the round bottomed flask and thermometer. No seal around collection flask. Three points shown, award 2 marks Two points shown, award 1 mark Propan-2-ol and propanone in correct locations, award 1 mark	3
2(a)(iii)	Propan-2-ol is flammable AND should not be heated directly / keep away from a naked flame / Bunsen burner	1

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Question	Answer	Marks
2(a)(iv)	Reagent: sodium carbonate / an alkali	1
	Explanation: carbonate added until no further effervescence / alkali added until indicator shows neutral / not acidic OR use an indicator to test when neutral / for a base/metal – (added until) some solid remains	1
2(b)(i)	It is faster / precipitate is drier (a comparison is required)	1
2(b)(ii)	Return it to the oven for a further period of time / Repeat drying. Reweigh. AND Continue with this process until the mass is constant	1
2(b)(iii)	M1 Mass of propanone = $5 \times 0.789 = 3.945$ g only	1
	M2 Mr Propanone = 58	1
	M3 Moles propanone = $3.945 / 58 = 0.0680$ Expected yield = $0.0680 \times 238 = 16.184$ g (16.18810345) % yield = $11.84 / 16.20 \times 100 = 73$ % (73.14013058)	1
2(b)(iv)	The reaction does not go to completion / is reversible / is an equilibrium reaction	1

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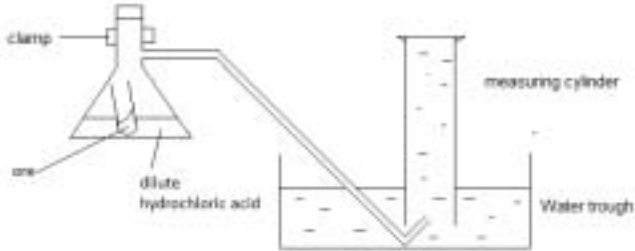
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Question	Answer	Mark
1(a)(i)	M1 The ore	1
	M2 The volume of gas / CO ₂	1
1(a)(ii)	Temperature (relating to collection of gas)	1
1(a)(iii)		
	M1 Contents of flask	1
	M2 Sealed apparatus	1
	M3 Collection of the gas in a labelled measuring cylinder (via a delivery tube into water)	1
1(b)	M1 CO ₂ is soluble in water / reacts with water	1
	M2 Use a (gas) syringe	1
1(c)(i)	To improve the reliability of the results	1
1(c)(ii)	(student has used an anomalous result and) correct value = 69 (cm ³)	1
1(d)	The acid will react with the hydroxide as well as the carbonate	1
1(e)(i)	M1 $n \text{ CO}_2 = 148 / 24\,000 = (0.006167)$	1
	M2 $M1 \times 114.9 = (0.70855)$	1
	M3 $(0.70855 / 2) \times 100 = 35.4\%$	1

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Question	Answer	Mark
1(e)(ii)	Mass of crucible and mass of crucible and ore (before heating) and mass of crucible and ore residue after heating	1
1(e)(iii)	heat to constant mass	1

Question	Answer	Mark																																								
2(a)	$\text{Cu} + 4\text{H}^+ + 2\text{NO}_3^- \rightarrow \text{Cu}^{2+} + 2\text{NO}_2 + 2\text{H}_2\text{O}$																																									
	M1 for correct products	1																																								
	M2 for balanced correct equation	1																																								
2(b)	$(2 \times 0.005) / 3.76 \times 100 = 0.27\%$	1																																								
2(c)	Wear gloves / goggles	1																																								
2(d)(i)	M1 Mr = 187.5 and n = $100 \times 0.8 / 1000 = 0.08$	1																																								
	M2 mass = $0.08 \times 187.5 = 15.0 \text{ g}$	1																																								
2(d)(ii)	<table><tr><td>0.00</td><td>20.00</td><td>0.00</td><td>0.00</td></tr><tr><td>1.00</td><td>19.00</td><td>0.04</td><td>0.12</td></tr><tr><td>3.00</td><td>17.00</td><td>0.12</td><td>0.36</td></tr><tr><td>4.00</td><td>16.00</td><td>0.16</td><td>0.48</td></tr><tr><td>5.50</td><td>14.50</td><td>0.22</td><td>0.66</td></tr><tr><td>7.50</td><td>12.50</td><td>0.30</td><td>0.89</td></tr><tr><td>9.00</td><td>11.00</td><td>0.36</td><td>1.06</td></tr><tr><td>10.50</td><td>9.50</td><td>0.42</td><td>1.25</td></tr><tr><td>12.00</td><td>8.00</td><td>0.48</td><td>1.41</td></tr><tr><td>15.00</td><td>5.00</td><td>0.60</td><td>1.76</td></tr></table>	0.00	20.00	0.00	0.00	1.00	19.00	0.04	0.12	3.00	17.00	0.12	0.36	4.00	16.00	0.16	0.48	5.50	14.50	0.22	0.66	7.50	12.50	0.30	0.89	9.00	11.00	0.36	1.06	10.50	9.50	0.42	1.25	12.00	8.00	0.48	1.41	15.00	5.00	0.60	1.76	1
	0.00	20.00	0.00	0.00																																						
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All values recorded to 2 DP																																										

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Question	Answer	Mark
2(d)(iii)	Burette	1
2(e)(i)	M1 Plots	1
	M2 Line	1
2(e)(ii)	Directly proportional	1
2(f)(i)	0.19 mol dm ⁻³	1
2(f)(ii)	M1 $0.19 \times 250 / 1000 \times 63.5 = 3.01625$	1
	M2 $3.01625 / 3.76 \times 100 = 80.2\%$	1

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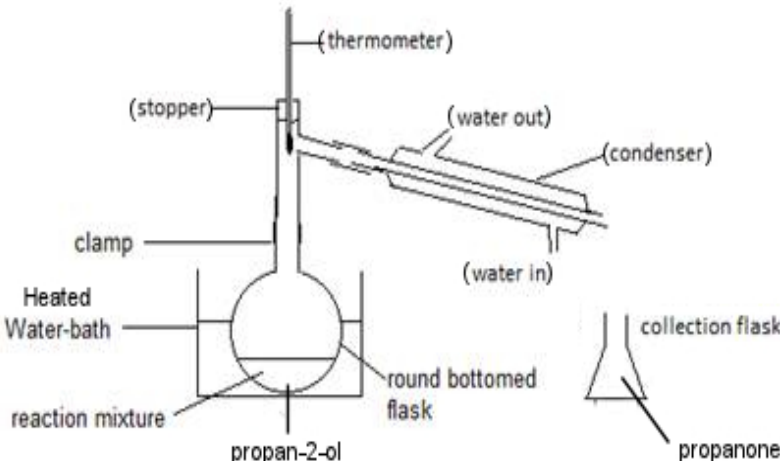
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