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CHEMISTRY **0620/41**

Paper 4 Extended Theory **October/November 2017**

MARK SCHEME

Maximum Mark: 80

Published

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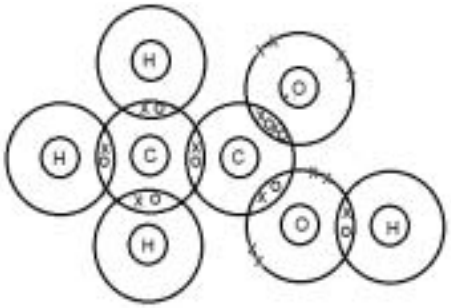
Question	Answer	Marks
1(a)(i)	**B**	**1**
1(a)(ii)	**A**	**1**
1(a)(iii)	**C**	**1**
1(a)(iv)	**E**	**1**
1(b)	O^{2-} **M1** O **M2** $^{2-}$	**2**

Question	Answer	Marks
2(a)(i)	**S**	**1**
2(a)(ii)	**S**	**1**
2(a)(iii)	**V**	**1**
2(b)	any value in the range 130–145 °C	**1**
2(c)	sublimation	**1**
2(d)(i)	Brownian motion	**1**
2(d)(ii)	nitrogen / oxygen / carbon dioxide / air molecules hit / bombard the smoke particles	**1**
	(the bombarding particles) move randomly	**1**

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Question	Answer	Marks
3(a)(i)	brown / orange solid (forms / is made) **OR** solution becomes paler / colourless	**1**
3(a)(ii)	magnesium is oxidised **AND** copper ions are reduced **OR** magnesium loses electrons **AND** copper ions gain electrons **OR** magnesium increases in oxidation number **AND** copper decreases in oxidation number	**1**
3(a)(iii)	Cu^{2+} **OR** copper(II) ions **OR** copper ions	**1**
	gains electrons	**1**
3(a)(iv)	$3Mg + Fe_2O_3 \rightarrow 3MgO + 2Fe$ **M1** Fe_2O_3 **AND** MgO **M2** fully correct	**2**
3(b)(i)	prevents air / oxygen **AND** water from reaching the steel	**1**
3(b)(ii)	magnesium is more reactive than iron / steel	**1**
	the magnesium corrodes (before the iron / steel) **OR** the magnesium corrodes preferentially	**1**
3(b)(iii)	copper is less reactive than iron / steel	**1**

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Question	Answer	Marks
4(a)(i)	→ $2(C_2H_5OH)$ + $2CO_2$ **M1** carbon dioxide made as product **M2** balanced	**2**
4(a)(ii)	any 2 from: • 37 °C • anaerobic • glucose is aqueous • yeast	**2**
4(b)(i)	(concentrated) phosphoric acid	**1**
4(b)(ii)	92 If full credit is not awarded, allow 1 mark for M_r of ethene = 28	**2**
4(c)(i)	(acidified) potassium manganate(VII) **OR** potassium (di)chromate(VI)	**1**
4(c)(ii)	 **M1** all shared pairs of electrons correct for single bonds **M2** 2 shared pairs of electrons for the C=O bond **M3** total of 8 electrons on each O including 4 non-bonding electrons and no additional non-bonding electrons	**3**
4(d)(i)	partially ionised / dissociated	**1**

Question	Answer	Marks
4(d)(ii)	**M1** (acids) have same concentration	**1**
	M2: measure pH **OR** describe how to measure pH (such as use Universal Indicator) **M3**: lower pH corresponds to the stronger acid / hydrochloric acid **OR** **M2**: add calcium / magnesium / zinc / iron **M3**: faster rate of forming bubbles corresponds to the stronger acid / hydrochloric acid **OR** **M2**: rate of reaction with (metal) carbonate **M3**: faster rate of forming bubbles corresponds to the stronger acid / hydrochloric acid **OR** **M2**: rate of reaction with (named) metal oxide **M3**: dissolves faster means that reaction is with the stronger acid / hydrochloric acid **OR** **M2**: electrical conductivity **M3**: greater conductivity corresponds to the stronger acid / hydrochloric acid **OR** **M2**: add sodium hydroxide (or other named alkali) **M3**: greater temperature change corresponds to the stronger acid / hydrochloric acid	**2**
4(e)	structure of propanoic acid	**1**
	propanoic acid	**1**
	structure of butan-1-ol	**1**
	butan-1-ol	**1**

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Question	Answer	Marks
5(a)(i)	*start colour:* green *end colour:* black	**1**
5(a)(ii)	$CuCO_3 \rightarrow CuO + CO_2$	**1**
5(b)(i)	(*copper(II) ions)* add sodium hydroxide (solution)	**1**
	(*copper(II) ions)* blue ppt.	**1**
	(*nitrate ions*) add aluminium **AND** aqueous sodium hydroxide **AND** warm	**1**
	ammonia given off / gas turns damp (red) litmus blue	**1**
5(b)(ii)	2 / 2 / 4 / 1	**1**
5(c)(i)	becomes paler	**1**
	equilibrium moves right	**1**
	(because) fewer moles (of gas) on right	**1**
5(c)(ii)	equilibrium moved right / more N_2O_4 / less NO_2	**1**
	(forward) reaction exothermic	**1**

Question	Answer	Marks
6(a)	aluminium is more reactive than carbon	**1**
6(b)(i)	oxide ion has an outer shell with six dots and two crosses	**1**
	oxide ion has a charge of 2^-	**1**

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Question	Answer	Marks
6(b)(ii)	(electrostatic) forces of attraction between ions	**1**
	(are) strong **OR** require lots of energy to overcome	**1**
6(c)(i)	*the wires:* electrons	**1**
	the electrolyte: ions	**1**
6(c)(ii)	any 2 from: • increases conductivity • as a solvent • lowers the operating temperature	**2**
6(c)(iii)	$Al^{3+} + 3e^- \rightarrow Al$	**1**
6(c)(iv)	oxygen is made at the anode	**1**
	the anodes are made of carbon	**1**
	oxygen (made) reacts with carbon	**1**
6(d)	aluminium coated with layer of (unreactive) aluminium oxide	**1**

Question	Answer	Marks
7(a)(i)	more particles (of acid) in a given volume / dm^3 / cm^3	**1**
	more collisions per second / unit time **OR** greater collision rate	**1**

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Question	Answer	Marks
7(a)(ii)	particles have more energy / particles move faster / more collisions per second / more collisions per unit time / greater collision rate	**1**
	more (of the) particles / collisions have energy greater than the activation energy / more particles have sufficient energy to react / more collisions have sufficient energy to react / a greater percentage of collisions are successful	**1**
7(b)(i)	0.075 If full credit is not awarded, allow 1 mark for M_r of CuO = 80	**2**
7(b)(ii)	0.05	**1**
7(b)(iii)	4 (g) **M1** moles copper(II) oxide that reacted = (0.05 / 2) = 0.025 mol **M2** mass copper(II) oxide = ((0.075 – 0.025) × 80) = 4 g	**2**
7(c)	$CCl_2CuH_4O_2$ **M1** 41.52 / 35.5; 37.43 / 64; 2.34 / 1; 18.71 / 16 **OR** 1.17 : 0.58 : 2.34 : 1.17 **M2** appropriate scaling to give whole number ratios	**2**

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