Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CHEMISTRY **0620/42**

Paper 4 Theory (Extended) **March 2017**

MARK SCHEME

Maximum Mark: 80

Published

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Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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Question	Answer	Marks
1(a)(i)	**A**	**1**
1(a)(ii)	**B and C**	**1**
1(a)(iii)	**D**	**1**
1(a)(iv)	**A**	**1**
1(a)(v)	**A**	**1**
1(a)(vi)	carbon dioxide **and** water	**1**
1(b)(i)	bitumen	**1**
1(b)(ii)	refinery gas	**1**
1(b)(iii)	refinery gas	**1**
1(b)(iv)	kerosene	**1**
1(b)(v)	heated / boiled / evaporated / vaporised	**1**

Question	Answer	Marks
2(a)	**M1** filter	**1**
	M2 wash (the residue) using water	**1**
	M3 dry the residue between filter papers / in a warm place	**1**
2(b)(i)	2^-	**1**
2(b)(ii)	$2Ag^+ + Cr_2O_7^{2-} \rightarrow Ag_2Cr_2O_7$	**1**
2(c)	**M1** Universal Indicator turns blue	**1**
	M2 <u>ammonia / NH_3</u> (is made)	**1**
2(d)(i)	**M1** dichromate ions / particles are heavier (than silver ions)	**1**
	M2 so dichromate ions diffuse / move more slowly **ORA**	**1**
	M3 (where they meet they react and) silver dichromate is made	**1**
2(d)(ii)	**M1** red solid forms in less than five minutes **or** red solid forms faster / sooner	**1**
	M2 particles / ions move faster	**1**
2(e)(i)	**M1** breaking down	**1**
	M2 when heated	**1**

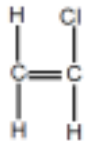
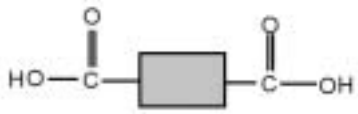
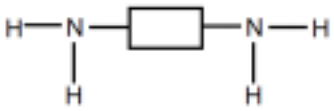
Question	Answer	Marks
2(e)(ii)	**M1** formula of chromium(III) oxide	**1**
	M2 rest of equation correct to give a fully correct equation ($(NH_4)_2Cr_2O_7 \rightarrow N_2 + Cr_2O_3 + 4H_2O$ scores [2])	**1**

Question	Answer	Marks
3(a)	any 2 from: • forward and backward reactions occur at equal rates • amounts / moles / concentrations (of substances) remain constant • closed system	**2**
3(b)	**M1** (particles) have more energy **OR** (particles) move faster	**1**
	M2 more collisions per second **OR** greater collision rate	**1**
	M3 more (of the) particles / collisions have energy greater than the activation energy **OR** more particles / collisions have sufficient energy to react **OR** a greater percentage / proportion / fraction of collisions are successful	**1**
3(c)	**M1** equilibrium moves left / yield decreases	**1**
	M2 because the forward reaction is exothermic **OR** because the reverse reaction is endothermic	**1**
3(d)	**M1** no change	**1**
	M2 numbers of moles of gas on each side is the same	**1**
3(e)(i)	**M1** all bonding pairs correct (two pair of electrons shared between O and N **AND** one pair of electrons shared between N and C*l*)	**1**
	M2 four non-bonding electrons on O **AND** two non-bonding electrons on N **AND** six non-bonding electrons on C*l* to give a fully correct diagram	**1**
3(e)(ii)	**M1** weak forces (of attraction)	**1**
	M2 between molecules / intermolecular	**1**

Question	Answer	Marks
4(a)(i)	arrow labelled **A** on or near wire going in an anti-clockwise direction	**1**
4(a)(ii)	arrow labelled **B** in electrolyte pointing towards the cathode	**1**
4(b)(i)	electrons are lost	**1**
4(b)(ii)	**M1** Cu^{2+} ions on left	**1**
	M2 rest of equation correct and correctly balanced ($Cu^{2+} + 2e^- \rightarrow Cu$ scores [2])	**1**
4(c)	**M1** anode mass decreases	**1**
	M2 copper lost as <u>ions</u> **OR** copper (atoms) becomes <u>ions</u> **OR** $Cu \rightarrow Cu^{2+} + 2e^-$	**1**
	M3 cathode mass increases	**1**
	M4 copper deposited / layer of copper forms / copper collected at cathode **OR** $Cu^{2+} + 2e^- \rightarrow Cu$	**1**

Question	Answer	Marks
5(a)	carbon dioxide <u>reacts</u> with carbon / coke **OR** $CO_2 + C \rightarrow 2CO$	**1**
5(b)	**M1** $CaO + SiO_2 \rightarrow CaSiO_3$	**1**
	M2 CaO is a base	**1**
	M3 SiO_2 is an acid	**1**
5(c)(i)	(the carbon makes the iron too) brittle	**1**
5(c)(ii)	reacted with oxygen / oxygen blown in	**1**
5(d)(i)	zinc blende	**1**
5(d)(ii)	$2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$	**1**
5(d)(iii)	any 2 from: • forms acid rain • kills trees / plants • kills fish • damages (limestone / marble) buildings / statues • causes breathing difficulties	**2**
5(d)(iv)	**M1** zinc boils	**1**
	M2 (both) impurities do not boil because their boiling point is above 1000 °C	**1**

Question	Answer	Marks
6(a)(i)	**M1** (relative formula mass $BaCO_3$ =) 197	**1**
	M2 (10.0/197 =) 0.0508 (0.0508 alone scores [2])	**1**
6(a)(ii)	1.22	**1**
6(b)	2.24	**1**
6(c)(i)	0.00219	**1**
6(c)(ii)	**M1** moles HC*l* = 2 × 0.00219 **OR** correct evaluation of this (= 0.00438)	**1**
	M2 (0.00438/0.01875) = 0.234 (0.234 alone scores [2])	**1**

Question	Answer	Marks
7(a)(i)	circle drawn round two consecutive carbons which includes 3 H atoms and 1 C*l* atom	**1**
7(a)(ii)		**1**
7(a)(iii)	**M1** stays yellow / orange / brown or no change	**1**
	M2 becomes colourless	**1**
7(b)(i)	polyamide	**1**
7(b)(ii)	circle must include exactly two C=O, two N–H, one shaded square and one unshaded square	**1**
7(b)(iii)	**M1** 	**1**
	M2 	**1**

Question	Answer	Marks
7(c)(i)	**M1** 34.61/12 : 61.54/16 : 3.85/1 **OR** 2.885 : 3.846 : 3.85	**1**
	M2 2.885/2.885 : 3.846/2.885 : 3.85/2.885 **OR** 1 : 1.3(33) : 1.3(33) **OR** 3:4:4	**1**
	M3 $C_3O_4H_4$	**1**
7(c)(ii)	relative formula mass / relative molecular mass	**1**