



Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CHEMISTRY

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Paper 4 Theory (Extended)

March 2017

MARK SCHEME

Maximum Mark: 80

Published

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[Turn over

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)	$2\text{Ag}^+ + \text{Cr}_2\text{O}_7^{2-} \rightarrow \text{Ag}_2\text{Cr}_2\text{O}_7$	1
2(c)	M1 Universal Indicator turns blue	1
	M2 ammonia / NH_3 (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

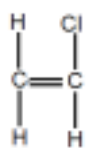
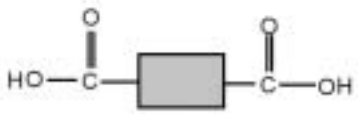
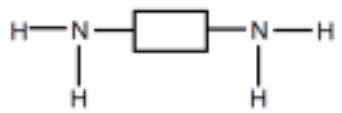
Question	Answer	Marks
2(e)(ii)	M1 formula of chromium(III) oxide	1
	M2 rest of equation correct to give a fully correct equation ($(\text{NH}_4)_2\text{Cr}_2\text{O}_7 \rightarrow \text{N}_2 + \text{Cr}_2\text{O}_3 + 4\text{H}_2\text{O}$ scores [2])	1

Question	Answer	Marks
3(a)	any 2 from: <ul style="list-style-type: none"> • 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) <i>l</i>	1
	M2 four non-bonding electrons on O AND two non-bonding electrons on N AND six non-bonding electrons on C <i>l</i> 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 ($\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$ 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 $\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}^-$	1
	M3 cathode mass increases	1
	M4 copper deposited/ layer of copper forms/ copper collected at cathode OR $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$	1

Question	Answer	Marks
5(a)	carbon dioxide <u>reacts</u> with carbon/ coke OR $\text{CO}_2 + \text{C} \rightarrow 2\text{CO}$	1
5(b)	M1 $\text{CaO} + \text{SiO}_2 \rightarrow \text{CaSiO}_3$	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)	$2\text{ZnS} + 3\text{O}_2 \rightarrow 2\text{ZnO} + 2\text{SO}_2$	1
5(d)(iii)	any 2 from: <ul style="list-style-type: none"> • 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 $\text{BaCO}_3 =$) 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 $\text{HCl} = 2 \times 0.00219$ 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 Cl 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