Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CHEMISTRY **0620/43**

Paper 4 Theory (Extended) **May/June 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)	**J**	**1**
1(a)(ii)	**E**	**1**
1(a)(iii)	**D**	**1**
1(a)(iv)	**J**	**1**
1(a)(v)	**L**	**1**
1(a)(vi)	**D**	**1**
1(b)(i)	(atoms with) same **number** of protons / atomic number / of same element	**1**
	different **numbe**r of neutrons / different mass number / different nucleon number	**1**
1(b)(ii)	**E AND G**	**1**
1(b)(iii)	they have the same number of electrons in their outer shell	**1**

Question	Answer	Marks
2(a)(i)	CH_2	**1**
2(a)(ii)	initial colour: orange	**1**
	final colour: colourless / none	**1**
2(b)(i)	approximately horizontal line draw to right of and below the reagent line	**1**
	energy change shown starting level with the reactant energy **AND** finishing level with the product energy **AND** having only one (correct) arrow head **AND** labelled ΔH / energy change	**1**
2(b)(ii)	(energy required to break bonds =) 3624	**1**
	(energy given out when bonds made =) 3738	**1**
	–114 (kJ / mol)	**1**
2(c)	(attractive) forces between molecules	**1**
	(forces of attraction) are strong<u>er</u> in iodine	**1**

Question	Answer	Marks
3(a)	regular arrangement / lattice of positive ions / magnesium ions / Mg^{2+} ions	**1**
	sea of electrons **OR** delocalised electrons	**1**
	attraction between (positive) ions and (delocalised / sea of) electrons	**1**
3(b)	electrons	**1**
	move / flow (throughout / through the structure)	**1**
3(c)	layers (of atoms or ions)	**1**
	layers / atoms / ions can slide / slip / glide (over each other) (without breaking the metallic bonds)	**1**
3(d)(i)	magnesium shown as (2, 8) using crosses	**1**
	sulfide shown as (2, 8, 8), with the two gained electrons in the outer shell of sulfur shown as crosses and all other electrons on sulfur shown as dots	**1**
	magnesium ion charge as 2^+ **AND** sulfide charge as $2^–$	**1**
3(d)(ii)	melt / fused	**1**
	ions can move **OR** are mobile	**1**

Question	Answer	Marks
4(a)	petroleum	**1**
4(b)(i)	*saturated:* only single bonds **OR** no double / multiple bonds (between carbon atoms)	**1**
	hydrocarbon: (compound that) contains carbon and hydrogen	**1**
	hydrocarbon: and no other elements / only	**1**
4(b)(ii)	alkane(s)	**1**
4(b)(iii)	any 2 from: • same / similar chemical properties • (same) general formula • (consecutive members) differ by CH_2 • same functional group • common (allow similar) methods of preparation • physical properties vary in predictable manner / show trends / gradually change / example of a physical property variation	**2**
4(b)(iv)	CO_2 and H_2O on right-hand side and no other products / reagents	**1**
	11 (O_2), 7 (CO_2), 8 (H_2O)	**1**
4(c)(i)	acid rain	**1**

Question	Answer	Marks
4(c)(ii)	*carbon monoxide*: from incomplete combustion (of fuel)	**1**
	oxides of nitrogen: nitrogen (from the air) reacts with oxygen (from the air)	**1**
	oxides of nitrogen: at high temperatures (in engine) **OR** (electrical) spark (in the engine)	**1**
4(c)(iii)	poisonous / toxic / death	**1**
4(c)(iv)	any 3 from: • oxides of nitrogen are reduced / lose oxygen (to form nitrogen) • oxides of nitrogen form nitrogen • (oxides of nitrogen) react with carbon monoxide • gases (adsorb / stick) on the catalyst's surface	**3**
4(d)(i)	butane	**1**
4(d)(ii)	(molecules with) the same molecular formula	**1**
	different structural formula / different displayed formula	**1**
4(d)(iii)	**UV** light / **sun**light	**1**
	H–C*l*	**1**
	any mono to deca chloro-substituted derivative of methyl propane	**1**

Question	Answer	Marks
5(a)(i)	loss (of electrons)	**1**
5(a)(ii)	$Ni \rightarrow Ni^{2+} + 2e^{-}$	**1**
5(a)(iii)	goes down / gets less / decreases / lower / smaller	**1**
5(b)(i)	beryllium	**1**
	most negative voltage with any (named) metal **OR** biggest voltage with cobalt / nickel	**1**
5(b)(ii)	cobalt **AND** nickel	**1**
5(b)(iii)	– sign	**1**
	2.7	**1**
5(c)	(set up cell) using magnesium and beryllium (electrodes)	**1**
	voltage positive if magnesium is metal 2	**1**
	OR	
	(set up cells) using both magnesium and beryllium with the same metal as the other electrode	**1**
	larger (magnitude) voltages with magnesium	**1**
	OR	
	use magnesium with a different metal and compare to a reference value in a table	**1**
	value is more negative than with beryllium, if magnesium is metal 1	**1**

Question	Answer	Marks
6(a)(i)	$BaCO_3 \rightarrow BaO + CO_2$	**1**
6(a)(ii)	anything pH in the range pH 10 to pH 14	**1**
6(a)(iii)	nitrogen dioxide	**1**
	oxygen	**1**
6(b)(i)	$Na_2CO_3 + Ba(NO_3)_2 \rightarrow BaCO_3 + 2NaNO_3$ **M1** formula of $NaNO_3$ **M2** equation fully correct	**2**
6(b)(ii)	filter	**1**
	wash (the residue) using water	**1**
	dry the residue between filter papers / in a warm place	**1**
6(c)(i)	$M_r = 197$	**1**
	(9.85 / 197 =) 0.05 (mol)	**1**
6(c)(ii)	0.05 (mol)	**1**
6(c)(iii)	$(0.05 \times 24) = 1.2$ (dm_3)	**1**
6(c)(iv)	moles of HC*l* at the start = $(250 / 1000 \times 1.00) = 0.25$	**1**
	moles HC*l* in excess = $0.25 - (2 \times 0.05) = 0.15$ (mol)	**1**