Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CHEMISTRY **0620/42**

Paper 2 Theory (Extended) **May/June 2018**

MARK SCHEME

Maximum Mark: 80

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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

Cambridge International will not enter into discussions about these mark schemes.

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

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GENERIC MARKING PRINCIPLE 5: Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
GENERIC MARKING PRINCIPLE 6: Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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Question	Answer	Marks
1(a)	distillation	**1**
1(b)	electrolysis	**1**
1(c)	filtration	**1**
1(d)	fractional distillation / fractionation	**1**
1(e)	chromatography	**1**

Question	Answer	Marks
2(a)	silicon / Si	**1**
2(b)	aluminium / Al	**1**
2(c)	sodium / Na	**1**
2(d)	chlorine / Cl_2 / Cl	**1**
2(e)	argon / Ar	**1**
2(f)	sulfur / S	**1**
2(g)	phosphorus / P	**1**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>3</td><td>
<table>
<tr><td>particles</td><td>number of protons</td><td>number of electrons</td><td>number of neutrons</td><td>number of nucleons</td></tr>
<tr><td></td><td></td><td></td><td>12 (1)</td><td></td></tr>
<tr><td></td><td>17 (1)</td><td>18 (1)</td><td></td><td>37 (1)</td></tr>
<tr><td>Fe (1) 2+ (1)</td><td></td><td></td><td></td><td></td></tr>
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</td><td>6</td></tr>
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Question	Answer	Marks
4(a)	$2K(s) + Br_2(l) \rightarrow 2KBr(s)$ 1 mark for formulae all correct 1 mark for balancing 1 mark for state symbols	**3**
4(b)(i)	(ionic): made of, positive and negative ions / anions and cations / oppositely charged ions / unlike charged ions / different charged ions	**1**
	(lattice): regular / sequence / pattern / alternating / repeated / framework / ordered / organised / network / uniform	**1**
4(b)(ii)	(in solid) ions don't move	**1**
	(when molten) ions move / ions mobile	**1**

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Question	Answer	Marks
4(c)(i)	substance that conducts electricity / (undergoes) electrolysis	**1**
	decomposed / chemically changed **OR** molten or liquid or solution or aqueous **AND** containing ions/or ionic	**1**
4(c)(ii)	$2H^+ + 2e(^-) \rightarrow H_2$ 1 mark for $H^+ + e(^-)$ as the only species on the left 1 mark for equation fully correct 1 mark for bromine at the anode 1 mark for potassium hydroxide	**4**
4(c)(iii)	potassium	**1**
4(d)(i)	$I_2 + Cl_2 \rightarrow 2ICl$ 1 mark for formulae all correct 1 mark for correct balancing	**2**
4(d)(ii)	one bonding pair	**1**
	6 non-bonding electrons on each atom	**1**
4(e)	(potassium bromide): ionic bonds / attraction between ions	**1**
	(iodine monochloride): intermolecular forces / forces between molecules / named intermolecular forces, e.g. van der Waals / London forces / dispersion forces / dipole- dipole	**1**
	bonds in KBr are stronger / need more energy to break bonds / ORA	**1**

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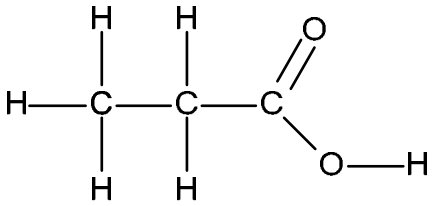
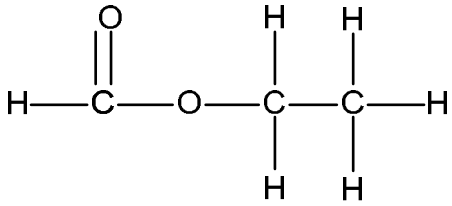
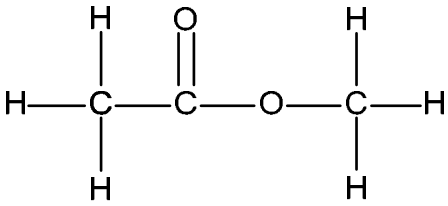
Question	Answer	Marks
4(f)(i)	$Cl_2 + 2e(^-) \rightarrow 2Cl^-$	**1**
4(f)(ii)	(bromide ions) lose electrons / donate electrons / are oxidised	**1**

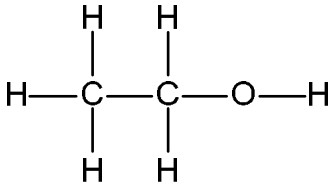
Question	Answer	Marks
5(a)	the rate of forward reaction equals (the rate of the) reverse reaction	**1**
	concentrations of reactants and products are constant	**1**
5(b)(i)	same number of gas moles on both sides of the equilibrium / same number of gas molecules on both sides of the equilibrium	**1**
5(b)(ii)	(increased pressure) particles or molecules (forced) closer together / same number of particles or molecules in a smaller volume	**1**
5(c)(i)	to left / towards reactants / in reverse direction	**1**
5(c)(ii)	increase / faster	**1**
	increase / faster	**1**

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Question	Answer	Marks
6(a)	(mix) sodium carbonate **AND** barium nitrate / barium chloride	**1**
	in solution / aqueous / dissolved (in water)	**1**
	filter / centrifuge (barium carbonate)	**1**
	wash (residue) **AND** dry / description of washing and drying	**1**
	$Ba(NO_3)_2 + Na_2CO_3 \rightarrow BaCO_3 + 2NaNO_3$ / $Ba^{2+} + CO_3^{2-} \rightarrow BaCO_3$ **OR** $BaCl_2 + Na_2CO_3 \rightarrow BaCO_3 + 2NaCl$	**1**
6(b)(i)	$2NaNO_3 \rightarrow 2NaNO_2 + O_2$ 1 mark for either $NaNO_2$ or O_2 on the right-hand side 1 mark for fully correct equation	**2**
6(b)(ii)	$2Cu(NO_3)_2.3H_2O(s) \rightarrow$ **2**$CuO(s)$ + **4**$NO_2(s)$ + $O_2(g)$ + **6**$H_2O(g)$ all 3 numbers = 2 marks any 2 numbers = 1 mark	**2**
6(b)(iii)	blue	**1**
	pink	**1**
6(b)(iv)	boiling point sharp / melting point sharp / freezing point sharp / boiling point 100 (°)C / freezing point or melting point 0 (°)C	**1**

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Question	Answer	Marks
7(a)	60 / 12 :13.33 / 1 : 26.67 / 16 or evaluation 5 : 13.33 : 1.67 or 3:8:1	**1**
	C_3H_8O	**1**
7(b)	(C_2H_4O =) 44	**1**
	$C_4H_8O_2$	**1**
7(c)(i)	structural isomers	**1**
7(c)(ii)	**T**  **V**  **OR** 	**2**
7(c)(iii)	$C_3H_6O_2 + 3½\ O_2 \rightarrow 3CO_2 + 3H_2O$ 1 mark for all formulae correct 1 mark for correct balancing	**2**

Question	Answer	Marks
7(d)(i)	alcohol / alkanol	**1**
7(d)(ii)		**1**
7(e)(i)	(they contain) carbon and hydrogen (atoms)	**1**
	only	**1**
7(e)(ii)	alkane: C_nH_{2n+2}	**1**
	alkene: C_nH_{2n}	**1**
7(f)	(step 1) crack / cracking (of octane)	**1**
	(step 1) equation with only C_8H_{18} on left hand side and C_2H_4 + other correct product(s) on right hand side e.g. $C_8H_{18} \rightarrow C_2H_4 + C_6H_{14}$	**1**
	(step 2) hydration / addition	**1**
	(step 2) one correct condition for **either** process required (cracking): 450 (°) C to 800 (°) C / zeolites / aluminosilicates / silica / SiO_2 / aluminium oxide / Al_2O_3 / alumina / china / broken pot / chromium oxide / Cr_2O_3 / up to 70 atmospheres (hydration): phosphoric acid / H_3PO_4 / 300 (°)C / 60 atmospheres	**1**
	$C_2H_4 + H_2O \rightarrow C_2H_5OH$ / CH_3CH_2OH	**1**

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