Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CHEMISTRY **0620/42**

Paper 4 Theory (Extended) **March 2019**

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.

Cambridge International is publishing the mark schemes for the March 2019 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

This syllabus is regulated for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

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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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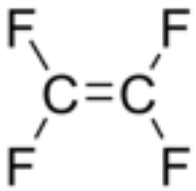
GENERIC MARKING PRINCIPLE 5: Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
GENERIC MARKING PRINCIPLE 6: Marks awarded are based solely 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)	chlorine / argon	**1**
1(b)	sodium	**1**
1(c)	argon	**1**
1(d)	sulfur	**1**
1(e)	aluminium	**1**
1(f)	silicon	**1**
1(g)	chlorine	**1**

Question	Answer	Marks
2(a)	<table><tr><td>number of protons</td><td>electrons</td><td>electronic structure</td><td>charge on particle</td></tr><tr><td>11</td><td>10</td><td>2,8</td><td>**M4 1+ / +1(1)**</td></tr><tr><td>**M1 18(1)**</td><td>18</td><td>**M3 2,8,8(1)**</td><td>0</td></tr><tr><td>**M2 9(1)**</td><td>10</td><td>2,8</td><td>1-</td></tr></table>	**4**
2(b)(i)	*element* **EITHER** (substance) made of **atoms** with the same atomic number / number of protons / proton number **OR** a substance that cannot be split up / broken down into two or more simple(r) substances by chemical means	**1**
2(b)(ii)	**M1** 6 protons in all three rows(1) **M2** 6,7 and 8 neutrons(1)	**2**

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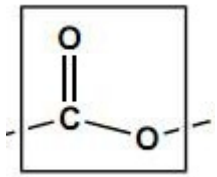
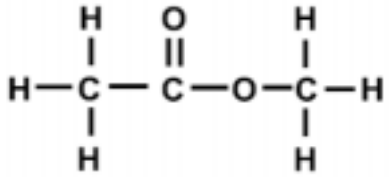
Question	Answer	Marks
3(a)	gas / gaseous	**1**
3(b)	**M1** 1 shared pair of electrons(1) **M2** 6 non-bonding electrons on each atom to complete an octet(1)	**2**
3(c)	$2Na + F_2 \rightarrow 2NaF$ **M1** NaF anywhere(1) **M2** equation fully correct(1)	**2**
3(d)	chlor**ine** less reactive than fluor**ine ORA**	**1**
3(e)(i)	PbF_2	**1**
3(e)(ii)	covalent	**1**
3(e)(iii)	giant ionic lattice	**1**
3(e)(iv)	**M1**(lt or lead(II) fluoride) forces of attraction between ions / ionic bonds(1) **M2**(tetrafluoromethane) forces of attraction between molecules(1) **M3** ionic bonds stronger than attractive forces between molecules / ionic bonds need more energy to break than attractive forces between molecules(1)	**3**
3(f)(i)	not all the bonds are single bonds	**1**
3(f)(ii)	**M1** bromine / bromine water(1) **M2** turns colourless / decolourises(1)	**2**
3(f)(iii)		**1**

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Question	Answer	Marks
3(f)(iv)	 **M1** C-C(1) **M2** each C bonded to 2 F and no other atoms + extension bonds(1)	**2**
3(f)(v)	**M1** CF_2(1) **M2** CF_2(1)	**2**

Question	Answer	Marks
4(a)	<table><tr><td>**M1** increases(1)</td><td>No change</td></tr><tr><td>**M2** increases(1)</td><td>**M3** decreases(1)</td></tr><tr><td>decreases</td><td>**M4** decreases(1)</td></tr></table>	**4**
4(b)	**M1** Suitable metal e.g. magnesium / any carbonate / any base(1) **M2** suitable observation e.g. insoluble base / insoluble carbonate / metal dissolve or disappear **or** metal / carbonate bubbles(1) **M3** balanced equation fully correct(1)	**3**
4(c)(i)	proton donor	**1**
4(c)(ii)	ionises / dissociates partially or incompletely	**1**
4(d)(i)	**M1** heat(1) **M2** catalyst / concentrated sulfuric acid(1)	**2**

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Question	Answer	Marks
4(d)(ii)	**M1** Correct ester linkage(1)  **M1** and **M2** whole molecule fully correct(2)  **M3** methyl ethanoate (1)	**3**
4(d)(iii)	ethyl methanoate	**1**

Question	Answer	Marks
5(a)(i)	fractional distillation	**1**
5(a)(ii)	carbon monoxide is toxic/poisonous	**1**
5(b)	80 5 10 240	**4**
5(c)(i)	$TiCl_4$ + **2**Mg → Ti + **2**$MgCl_2$	**1**

Question	Answer	Marks
5(c)(ii)	$TiCl_4 + 4Na \rightarrow Ti + 4NaCl$	**1**
5(c)(iii)	magnesium burns in air or oxygen **OR** reacts with air or oxygen / argon is unreactive or inert	**1**
5(d)(i)	**M1 / 2** bubbles / fizzing / effervescence(1) **M1 / 2** (magnesium or solid) dissolves / disappears / **forms** solution(1) **M3** $Mg + 2HCl \rightarrow MgCl_2 + H_2$(1)	**3**
5(d)(ii)	filtration	**1**
5(d)(iii)	titanium is below hydrogen in the reactivity series **ORA** **OR** titanium less reactive than hydrogen **ORA** **OR** titanium coated with an oxide layer	**1**
5(e)(i)	hydrogen	**1**
5(e)(ii)	Heat until magnesium chloride is molten and electrolyse	**1**

Question	Answer	Marks
6(a)	**M1** Transition element has higher melting point / high boiling point **ORA**(1) **M2** Transition element has higher density **ORA**(1)	**2**
6(b)	good conduction of heat or electricity **OR** malleability **OR** ductility	**1**
6(c)	1 mark each for any two of: catalyst more than one or different or variable oxidation state / oxidation number / valency coloured **compounds** / coloured **ions**	**2**

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Question	Answer	Marks
6(d)	from blue(1) to pink(1)	**2**
6(e)(i)	**M1** oxygen(1) **M2** water(1)	**2**
6(e)(ii)	zinc / Zn	**1**
6(f)	**M1** magnesium above iron / steel in the reactivity series **ORA** / magnesium more reactive than iron / steel **ORA**(1) **M2** copper below iron / steel in the reactivity series **ORA /** copper less reactive than iron **ORA**(1)	**2**
6(g)(i)	$Fe_2O_3 + 2H_3PO_4 \rightarrow 2FePO_4 + 3H_2O$ **M1** $FePO_4$ anywhere(1) **M2** The whole equation correct(1)	**2**
6(g)(ii)	iron(III) phosphate acts as a barrier which prevents contact between iron and water or air / oxygen	**1**

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