Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CHEMISTRY **0620/41**

Paper 4 Theory (Extended) **October/November 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.

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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)(i)	K^+	1
1(a)(ii)	Cr^{3+}	1
1(a)(iii)	Ca^{2+}	1
1(a)(iv)	Br^-	1
1(a)(v)	SO_4^{2-}	1
1(b)	(compound / salt) on wooden splint **or** (nichrome / platinum) wire (1) into (roaring) Bunsen flame (1)	2
1(c)	$Mg_3(PO_4)_2$	1

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Question	Answer	Marks
2(a)	atoms with same number of protons **or** atoms of the same element **or** atoms with same atomic number (1) atoms with different number of neutrons **or** atoms with different mass number **or** atoms with different nucleon number (1)	**2**
2(b)(i)	18	**1**
2(b)(ii)	gain of two electrons	**1**
2(b)(iii)	Ca / calcium	**1**
2(c)(i)	l…..g…..g.	**1**
2(c)(ii)	vanadium (V) oxide **or** vanadium pentoxide (1) 450 (°C) (1)	**2**
2(c)(iii)	$SO_3 + H_2SO_4 \rightarrow H_2S_2O_7$ (1) $H_2S_2O_7 + H_2O \rightarrow 2\ H_2SO_4$ (1)	**2**
2(d)(i)	(it causes) acid rain	**1**
2(d)(ii)	test – (aqueous) potassium manganate (VII) (1) (purple to) colourless (1)	**2**
2(e)	29.1 / 23 40.5 / 32 30.4 / 16 **or** 1.2(65) 1.2(65) 1.9 (1) 1:1:1.5 (1) $Na_2S_2O_3$ (1)	**3**

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Question	Answer	Marks
3(a)	malleable / conduct electricity / conduct heat	1
3(b)	water and oxygen / air	1
3(c)(i)	(zinc is) more reactive than iron	1
3(c)(ii)	Fe^{3+} (1) accept / take / gain electrons (1)	2
3(d)	(add a) named acid (1) (add a) named alkali (1) disappears / dissolves in both (1)	3

Question	Answer	Marks
4(a)(i)	cobalt carbonate	1
4(a)(ii)	lead iodide	1
4(b)	$2\ AgNO_3 + Na_2CO_3 \rightarrow Ag_2CO_3 + 2\ NaNO_3$ formula of silver carbonate correct (1) fully correct equation (1)	2
4(c)	$Pb^{2+} + 2\ I^- \rightarrow PbI_2$ Pb^{2+} **and** I^- on left of equation (1) fully correct equation (1)	2
4(d)	(nitric) acid reacts with / removes carbonate ions	1

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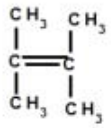
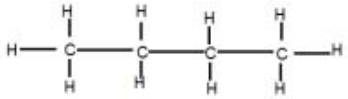
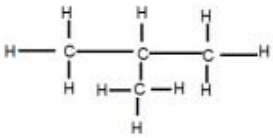
Question	Answer	Marks
5(a)(i)	addition	**1**
5(a)(ii)	CH_2	**1**
5(a)(iii)	 one C=C (1) fully correct structure (1)	**2**
5(b)(i)	(compounds / molecules with) the same molecular formula (1) different structural formulae (1)	**2**
5(b)(ii)	 (1)  (1)	**2**
5(b)(iii)	H_2O **and** CO **or** C formed (1) $2\ C_4H_{10} + 9\ O_2 \rightarrow 8\ CO + 10\ H_2O$ (1)	**2**

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Question	Answer	Marks
6(a)	correct final answer = 0.072(0) **M1** moles HC*l* = 0.0036(0) **M2** moles Na_2CO_3 = 0.0018(0) (**M1** / 2) **M3** concentration Na_2CO_3 = 0.072 (**M2** / 0.025)	**3**
6(b)	0.002(00)	**1**
6(c)(i)	720(.09)	**1**
6(c)(ii)	(it contains) ions (1) (ions) are able to move (1)	**2**
6(c)(iii)	magnesium is not inert	**1**
6(b)(iv)	bromine / Br_2	**1**
6(b)(v)	H^+ and $e^{(-)}$ on LHS (1) fully correct, i.e.: $2H^+ + 2e^- \rightarrow H_2$ (1)	**2**
7(a)	$C_6H_{12}O_6 \rightarrow 2CO_2 + 2C_2H_5OH$ (1) any three from anaerobic 30 °C yeast glucose aqueous fractional distillation (of aqueous ethanol) (1)	**5**
7(b)	(energy to break bonds) = 4728 (1) (energy released by making bonds) = 6004 (1) –1276 (1)	**3**

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Question	Answer	Marks
7(c)(i)	speeds up a (chemical) reaction (1) not used up **or** unchanged (at end) (1)	**2**
7(c)(ii)	4 electrons in double bond between C and O (1) all single bonds correct (1) C and O each have 8 electrons in outer shell, all H have 2 electrons in outer shell (1)	**3**
7(c)(iii)	(attractive) forces between molecules weak**er** in ethanal	**1**
7(d)(i)	moves right (1) fewer moles / molecules (of gas) on right (1)	**2**
7(d)(ii)	(reaction is faster) because more collisions per second (1) particles / molecules closer together **or** more particles / molecules per unit volume (1)	**2**
7(d)(iii)	moves left (1) (forward) reaction is exothermic **or** backward reaction is endothermic (1)	**2**

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