Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CHEMISTRY **0620/41**

Paper 4 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.

Cambridge International is publishing the mark schemes for the May/June 2018 series for most Cambridge IGCSE™, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

This syllabus is approved 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.

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.

Question	Answer	Marks
1(a)	a substance made from two (or more) **elements**	**1**
	chemically combined	**1**
1(b)	dissolving	**1**
	filtration	**1**
	evaporation / crystallisation	**1**
	three correct stages in the correct order	**1**
1(c)(i)	condenser	**1**
	arrow pointing into lower aperture **only**	**1**
1(c)(ii)	stopper shown in diagram	**1**
	gases or vapours escape	**1**
1(c)(iii)	(mixture is) (in)flammable	**1**
1(c)(iv)	water bath cannot exceed 100 (°C)	**1**
	C AND D have a boiling point above 100 (°C)	**1**

Question	Answer	Marks
2(a)	calcium / Ca	**1**
2(b)	7	**1**
2(c)	4	**1**
2(d)(i)	radioisotopes	**1**
2(d)(ii)	^{286}Fl 114p 172n 114e	**1**
	^{289}Fl 114p 175n 114e	**1**
2(e)(i)	any **two** from: high melting point / boiling point hard dense conduct electricity conduct heat ductile / malleable sonorous lustrous / shiny	**2**
2(e)(ii)	basic (oxide)	**1**

Question	Answer	Marks
3(a)	(hot) air	**1**
3(b)	coke is burned (to form carbon dioxide) **OR** $C + O_2 \rightarrow CO_2$	**1**
	carbon dioxide is reduced by (more) coke to form **carbon monoxide** or **CO** **OR** $C + CO_2 \rightarrow 2CO$	**1**
	$3CO + Fe_2O_3 \rightarrow 2Fe + 3CO_2$	**1**
	limestone (decomposes to) form lime / CaO / calcium oxide (and carbon dioxide) **OR** $CaCO_3 \rightarrow CaO + CO_2$	**1**
	$CaO + SiO_2 \rightarrow CaSiO_3$	**1**
3(c)	the impurity is C	**1**
	blow **into** or pass oxygen **through** (molten) **iron**	**1**
	carbon dioxide escapes or carbon dioxide is a gas	**1**

Question	Answer	Marks
4(a)	relative atomic mass	**1**
4(b)	C_4H_{10} is covalent	**1**
	KF is ionic	**1**
4(c)	mol of **Y** = 0.060 / 24.0 = 2.5×10^{-3} or 0.0025	**1**
	M_r = 0.095 / 2.5×10^{-3} = 38(.0)	**1**
	fluorine	**1**
4(d)	mass of O = 3.87 g – 1.68 g = 2.19 (g)	**1**
	mol of P and mol of O 1.68 / 31 OR 0.054.. 2.19 / 16 **OR** 0.13…	**1**
	ratio of P to O P = 0.054… / 0.054 O = 0.13… / 0.054… = 1 = 2.5	**1**
	whole number ratio and P_2O_5 = 2 = 5	**1**
4(e)	the formula is P_4O_6 or (one mole of) P_2O_3 = 110 (g)	**1**
	mass = 220 (g)	**1**

Question	Answer	Marks
5(a)(i)	(a substance which) increases the rate of a reaction	**1**
	without being used up (at the end) / remains unchanged or unaffected or without changing mass	**1**
5(a)(ii)	variable oxidation states	**1**
5(b)	any **two** from: high(er) melting point / boiling point (very) hard(er) (very) strong(er) dense(r)	**2**
5(c)(i)	$ZnSO_4$	**1**
	H_2 written on product line	**1**
	states (aq) **AND** (g)	**1**
5(c)(ii)	(labelled) arrow pointing upwards starting level with reactants and finishing level with top of the hump.	**1**
5(c)(iii)	exothermic **AND** products are at lower energy (than reactants)	**1**
5(d)	lower hump starting from reactants line	**1**
5(e)(i)	$Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$ 1 mark for any equation which has Cu as the product or Cu^{2+} ions on left 1 mark for correct species 1 mark for correct state symbols	**3**
5(e)(ii)	(a pink / brown) solid / deposit forms	**1**
5(e)(iii)	bubbles / fizzing (at the anode)	**1**
	solution becomes paler / less blue / colourless	**1**

Question	Answer	Marks
5(e)(iv)	a green gas would be seen (on the anode)	**1**

Question	Answer	Marks
6(a)	(they contain) carbon and hydrogen (atoms)	**1**
	only	**1**
6(b)	(all) the (C–C) bonds are single	**1**
6(c)(i)	(one) atom or group is replaced by another (atom or group)	**1**
6(c)(ii)	ultra-violet light **OR** sunlight	**1**
6(c)(iii)	$C_2H_6 + Cl_2 \rightarrow C_2H_5Cl + HCl$ 1 mark for C_2H_5Cl 1 mark for the rest of the equation	**2**
6(d)(i)	only one product (compound) forms	**1**
6(d)(ii)	fully displayed formula of 1,2-dibromopropane	**1**
6(e)	fully displayed formula of but-2-ene	**1**
	but-2-ene	**1**

Question	Answer	Marks
6(f)(i)	poly(ethene)	**1**
6(f)(ii)	single bond between two C atoms	**1**
	fully correct answer	**1**
6(g)	any one correct amide link showing all bonds	**1**
	both amide links shown in the correct orientation for three amino acids	**1**
6(h)	ethanol + butanoic acid → ethyl butanoate + water 1 mark for the names of the reactants 1 mark for the name of the ester 1 mark for water as a product	**3**