Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CHEMISTRY (US) **0439/43**

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.

PUBLISHED

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)	Cl_2 / chlorine	**1**
1(b)	SO_2 / sulfur dioxide	**1**
1(c)	Cu / copper	**1**
1(d)	Ar / argon	**1**
1(e)	$Ca(OH)_2$ / calcium hydroxide	**1**
1(f)	V_2O_5 / vanadium(V) oxide	**1**

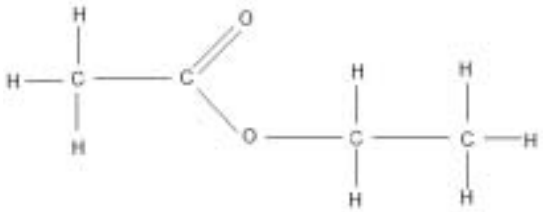
Question	Answer	Marks
2(a)(i)	similarities: number of protons **and** electrons	**1**
	differences: number of neutrons	**1**
2(a)(ii)	nucleons: 27	**1**
	neutrons: 14	**1**
	electrons: 10	**1**
2(b)(i)	bauxite	**1**
2(b)(ii)	aluminium is more reactive than carbon	**1**
2(b)(iii)	to lower the operating temperature / the mixture has a lower melting point than aluminium oxide	**1**
	to increase the conductivity	**1**

Question	Answer	Marks
2(b)(iv)	oxidation (because) (the O^{2-} ion OR 'oxide ions') electrons are lost **OR** (the O^{2-} ion OR 'oxide ions') oxidation number increases	**1**
2(b)(v)	electrodes/anodes are made from carbon/graphite	**1**
	oxygen (made) reacts with carbon/anode	**1**
2(c)(i)	zinc is more reactive than copper	**1**
2(c)(ii)	displacement / redox	**1**
2(c)(iii)	(aluminium) has (inert) coating of aluminium oxide	**1**

Question	Answer	Marks
3(a)	any **one** from: conduct electricity conduct heat malleable ductile shiny	**1**
3(b)(i)	any **one** from: melting point hardness strength density	**1**
3(b)(ii)	(cobalt) high(er) / (cobalt) strong(er)	**1**

Question	Answer	Marks
3(c)	any **two** from: potassium melts / potassium forms a ball fizzes / bubbles potassium moves (lilac) flame	**2**
3(d)(i)	test: lighted splint / flame result: (squeaky) pop	**2**
3(d)(ii)	any **one** from: increase surface area (of cobalt) powder the metal add a catalyst	**1**
3(d)(iii)	(particles) have more energy / (particles) move faster	**1**
	more collisions per second / greater collision rate	**1**
	more of the colliding molecules have sufficient energy (activation energy) to react	**1**
3(e)(i)	becomes pink / becomes purple	**1**
	equilibrium moves right	**1**
3(e)(ii)	(forward reaction is) exothermic	**1**
3(f)	3+	**1**

Question	Answer	Marks
4(a)	any **two** from: trend in physical properties same/similar chemical properties (same) general formula successive members differ by CH_2 same functional group	**2**
4(b)	all bonding pairs correct and no extra incorrect non-bonding electrons	**1**
	4 non-bonding electrons on O completing oxygen octet	**1**
4(c)(i)	$C_2H_4 + H_2O \rightarrow C_2H_5OH$	**1**
4(c)(ii)	$C_6H_{12}O_6 \rightarrow 2CO_2 + 2C_2H_5OH$	**1**
4(c)(iii)	any **one** from: pure(r) product fast(er) reaction continuous process	**1**
4(c)(iv)	any **one** from: renewable feedstock low**er** temperature low**er** pressure	**1**
4(d)	(acidified) potassium manganate(VII)	**1**

Question	Answer	Marks
4(e)(i)	ester linkage correct	**1**
	fully correct molecule 	**1**
4(e)(ii)	ethyl ethanoate	**1**
4(e)(iii)	ester	**1**
4(f)(i)	partially dissociated / partially ionised	**1**
4(f)(ii)	add excess copper(II) carbonate to ethanoic acid	**1**
	filter	**1**
	heat to point of crystallisation **AND** leave (to cool)	**1**
4(f)(iii)	ethanoic acid + copper carbonate → copper ethanoate + carbon dioxide + water	**1**

Question	Answer	Marks
5(a)	14.01/59 : 60.33/127 : 2.85/1 : 22.81/16 **OR** 0.237 : 0.475 : 2.85 : 1.43	**1**
	$NiI_2H_{12}O_6$	**1**
5(b)(i)	electrons	**1**
5(b)(ii)	(positive and negative) ions	**1**
5(b)(iii)	nickel	**1**
	iodine	**1**
	$Ni^{2+} + 2e^- \rightarrow Ni$ **OR** $2I^- \rightarrow I_2 + 2e^-$	**1**
5(c)(i)	copper formed/copper deposited	**1**
5(c)(ii)	oxygen	**1**
5(c)(iii)	copper removed or copper lost **or** copper forms ions	**1**
5(c)(iv)	any **three** from: (apparatus **A**): solution becomes paler/fades in **A** (apparatus **B**): solution stays the same colour in **B** (explanation): copper ions removed (but not added) copper ions not replaced in **A** **OR** copper ions both removed and added (at the same rate) copper ions are being replaced (continually)	**3**

Question	Answer	Marks
6(a)(i)	74	**1**
	0.12	**1**
6(a)(ii)	0.3	**1**
6(a)(iii)	0.02	**1**
6(a)(iv)	207	**1**
	4.14	**1**
6(a)(v)	75%	**1**
6(b)(i)	heat it	**1**
6(b)(ii)	$Ca(ClO_3)_2 \rightarrow CaCl_2 + 3O_2$ 1 mark for O_2 as product 1 mark for the rest correct and balanced	**2**
6(c)(i)	red	**1**
6(c)(ii)	proton donor	**1**
6(c)(iii)	$\rightarrow ClO_3^- + H_3O^+$	**1**