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Cambridge International General Certificate of Secondary Education

CHEMISTRY

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Paper 4 Extended Theory

October/November 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 October/November 2018 series for most Cambridge IGCSE™, Cambridge International A and AS Level 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.

This document consists of **11** printed pages.



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)	oxygen	1
1(b)	hematite	1
1(c)	sulfur dioxide	1
1(d)	ammonia	1
1(e)	carbon monoxide	1
1(f)	sodium chloride	1
1(g)	carbon dioxide	1
1(h)	oxygen	1

Question	Answer	Marks
2(a)(i)	M1 breakdown of an ionic compound when molten or in aqueous solution M2 (using) electricity / electric current	2
2(a)(ii)	M1 electron(s) M2 ion(s)	2
2(b)(i)	M1 inert / unreactive M2 conducts electricity	2

Question	Answer				Marks
2(b)(ii)	observation at anode(+)	name of product at anode(+)	observation at cathode(–)	name of product at cathode(–)	6
	M1 green / yellow bubbles	M2 chlorine		M3 hydrogen	
		M4 oxygen	M5 pink / brown solid	M6 copper	

Question	Answer	Marks
3(a)	$[(64 \cdot 2) + 56 + 119 + (32 \cdot 4)] =$ 431	1
3(b)	$[(119 / 151) \cdot 100] =$ 78.8 (%)	1
3(c)	SnO ₂ because the percentage of tin is larger in SnO ₂ or answer to (b) > 27.6 %	1
3(d)	SnO ₂ + 2C → Sn + 2CO M1 all formulae correct M2 equation fully correct	2
3(e)	M1 (→) Fe ²⁺ + Sn OR 2Fe + 3Sn ²⁺ → 2Fe ³⁺ + 3Sn M2 (→) Sn ²⁺ + Cu OR Sn + 2Cu ²⁺ → Sn ⁴⁺ + 2Cu	2
3(f)(i)	M1 glowing splint M2 relights / rekindles	2

Question	Answer	Marks						
3(f)(ii)	M1 nitrogen dioxide / nitrogen(IV) oxide M2 brown (gas)	2						
3(f)(iii)	$2\text{Cu}(\text{NO}_3)_2 \rightarrow 2\text{CuO} + 4\text{NO}_2 + \text{O}_2$	1						
3(g)(i)	zinc acts as a barrier which prevents contact between iron and water and air / oxygen	1						
3(g)(ii)	SUMMARY <table border="1"><tr><td>M1</td><td>comparison of reactivity</td></tr><tr><td>M2</td><td>zinc loses electrons</td></tr><tr><td>M3</td><td>where electrons move to OR iron does not lose electrons</td></tr></table> M1 zinc is more reactive than iron / steel ORA M2 zinc loses electrons / zinc is oxidised M3 electrons are transferred to iron / iron is not oxidised / iron does not lose electrons	M1	comparison of reactivity	M2	zinc loses electrons	M3	where electrons move to OR iron does not lose electrons	3
M1	comparison of reactivity							
M2	zinc loses electrons							
M3	where electrons move to OR iron does not lose electrons							

Question	Answer	Marks
4(a)	M1 (Mol KOH =) $0.00125 / 1.25 \cdot 10^{-3}$ M2 (Mol H_2SO_4 =) $0.000625 / 6.25 \cdot 10^{-4}$ M3 (Conc H_2SO_4 =) $0.03125 / 3.125 \cdot 10^{-2} (\text{mol} / \text{dm}^3)$	3

Question	Answer	Marks										
4(b)	SUMMARY <table><tr><td>M1</td><td>repeat</td></tr><tr><td>M2</td><td>heat (liquid or solution should be implied)</td></tr><tr><td>M3</td><td>when to stop heating</td></tr><tr><td>M4</td><td>what to do after heating</td></tr><tr><td>M5</td><td>method of drying crystals (crystals or solid should be implied)</td></tr></table> M1 repeat without indicator using same volumes M2 evaporate / heat / warm / boil / leave in sun M3 until most of the water is gone / some water left / saturation(point) / crystallisation point / evaporate some of the water M4 leave / (allow to) cool / allow to crystallise M5 details of drying	M1	repeat	M2	heat (liquid or solution should be implied)	M3	when to stop heating	M4	what to do after heating	M5	method of drying crystals (crystals or solid should be implied)	5
M1	repeat											
M2	heat (liquid or solution should be implied)											
M3	when to stop heating											
M4	what to do after heating											
M5	method of drying crystals (crystals or solid should be implied)											
4(c)(i)	M1 bubbles / effervescence / fizzing M2 solid or magnesium dissolves / solid or magnesium disappears	2										
4(c)(ii)	lilac flame	1										
4(c)(iii)	white precipitate	1										
4(d)(i)	$\text{Mg(OH)}_2 + \text{H}_2\text{SO}_4 \rightarrow \text{MgSO}_4 + 2\text{H}_2\text{O}$ M1 formula of both Mg(OH)_2 and MgSO_4 M2 equation fully correct	2										

Question	Answer	Marks
4(d)(ii)	$\text{Zn} + \text{H}_2\text{SO}_4 \rightarrow \text{ZnSO}_4 + \text{H}_2$ M1 formula of ZnSO_4 M2 equation fully correct	2
4(d)(iii)	$\text{Na}_2\text{CO}_3 + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + \text{CO}_2 + \text{H}_2\text{O}$ M1 formulae of both Na_2CO_3 and Na_2SO_4 M2 equation fully correct	2

Question	Answer	Marks
5(a)	M1 volume of gas M2 time	2
5(b)	M1 rate decreases / reaction gets slower M2 concentration of acid decreases M3 fewer collisions per unit time	3

Question	Answer	Marks
5(c)	M1 particles have more kinetic energy M2 particles move faster M3 more collisions per unit time M4 more of the particles have energy greater than or equal to activation energy / more of the collisions have energy greater than or equal to activation energy OR more of the particles have sufficient energy to react / more of the collisions have sufficient energy to react OR A greater percentage or greater proportion or greater fraction of collisions are successful	4
5(d)	ANY TWO FROM: increase concentration of hydrochloric acid decrease particle size of calcium carbonate / increase surface area of calcium carbonate (add)catalyst	2

Question	Answer	Marks						
6(a)(i)	SUMMARY <table><tr><td>M1 and M4</td><td>reactants</td></tr><tr><td>M2 and M5</td><td>conditions</td></tr><tr><td>M3 and M6</td><td>equation</td></tr></table> FERMENTATION: M1 glucose / sucrose / starch / other named carbohydrate can score in equation as correct formula M2 Zymase / Yeast / 37°C M3 $C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$ HYDRATION: M4 Ethene and steam or water can score in equation as correct formulae M5 H_3PO_4 (catalyst) / 300°C / 60 atm M6 $C_2H_4 + H_2O \rightarrow C_2H_5OH$	M1 and M4	reactants	M2 and M5	conditions	M3 and M6	equation	6
M1 and M4	reactants							
M2 and M5	conditions							
M3 and M6	equation							
6(a)(ii)	ANY TWO FROM:- carbohydrates are renewable fossil fuels are non-renewable lower temperature means fossil fuels conserved ORA lower temperature means lower energy costs ORA hydration reaches an equilibrium meaning lower yield ORA	2						
6(a)(iii)	M1 solvent M2 fuel	2						
6(b)(i)	E	1						

Question	Answer	Marks
6(b)(ii)	D	1
6(b)(iii)	B	1
6(b)(iv)	C	1
6(b)(v)	A	1