Cambridge IGCSE

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education (9–1)

CHEMISTRY **0971/41**

Paper 4 Theory (Extended) **May/June 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 May/June 2019 series for most Cambridge IGCSE™, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

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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)	number of protons (1) protons in the nucleus (of an atom) (1)	2
1(b)(i)	12p 12n 12e (1) 12p 14n 12e (1)	2
1(b)(ii)	isotope(s)	1
1(b)(iii)	same number of electrons (1) (same number) of electrons in the outer shell (1)	2
1(c)	${}^{9}_{4}Be$ any element symbol with a single negative charge (1) use of Cl (1) use of ${}^{37}{}_{17}$ (1)	4
1(d)	2 8 3 (1) 2 8 8 (1)	2

Question	Answer	Marks
2(a)	80(°C) (1)	1
2(b)	horizontal line from end of graph at minute 9 to minute 11 (1)	1
2(c)	energy is used to break bonds / overcome attraction (1) between molecules (1)	2

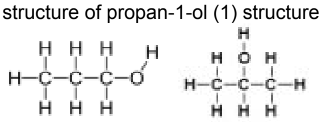
Question	Answer	Marks
2(d)	vibrations (1) increase (1)	**2**
2(e)	melting point decreases (1) boiling point increases (1)	**2**
2(f)	decrease from 120 °C to 80 °C and horizontal line at 80 °C (1) decrease from horizontal line to finish at 20 °C at 8 mins (1)	**2**

Question	Answer	Marks
3(a)	roast zinc blende (in air) (1) $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$ (1) add/react with coke (1) $ZnO + C \rightarrow Zn + CO$ **OR** $2ZnO + C \rightarrow 2Zn + CO_2$ (1) (zinc is) distilled (1)	**5**
3(b)	brass	**1**
3(c)	form coloured compounds / ions (1) act as catalysts (1)	**2**
3(d)(i)	**anhydrous** copper(II) sulfate	**1**
3(d)(ii)	white (1) blue (1)	**2**

Question	Answer	Marks
3(e)(i)	4KI + 2$CuSO_4$ → 2CuI + I_2 + 2K_2SO_4 (2)	2
3(e)(ii)	1+	1
3(e)(iii)	gains electron(s)	1
3(e)(iv)	KI / potassium iodide / iodide (ions) / I^-	1

Question	Answer	Marks
4(a)(i)	proton donor	1
4(a)(ii)	(CH_3COOH) ⇌ CH_3COO^- (1) + H^+ (1)	2
4(b)(i)	any **two** from: • faster rate of fizzing • solid dissolves quicker / disappears quicker / gets smaller quicker • fizzing stops quicker • dissolving stops quicker	2
4(b)(ii)	any **three** from: • temperature • volume (of acid) • concentration (of acid) • mass / amount (of $CaCO_3$) • particle size / surface area (of $CaCO_3$)	3

Question	Answer	Marks
4(c)	**M1** mol of $HCl = 2.00 \times \frac{50.0}{1000} = 0.1(00)$ mol (1) **M2** mol of $MgCO_3 = \frac{\textbf{M1}}{2} = 0.1(00) / 2 = 0.05(00)$ (1) **M3** M_r of $MgCO_3 = 84$ (1) **M4** mass of $MgCO_3$ = **M3** × **M2** = 84 × 0.05(00) = 4.2(0)g (1)	4
4(d)(i)	to remove the acid / make sure all the acid is used up / no acid is left over	1
4(d)(ii)	to make sure all the filtrate / $MgCl_2$ / salt goes through / no $MgCl_2$ left behind	1
4(d)(iii)	evaporation mark (1) the starting of crystallisation mark (1) drying the crystals mark (1)	3
4(e)(i)	a solid (1) which forms when two solutions are mixed / reacted / added (1)	2
4(e)(ii)	(silver) nitrate (1) $BaCl_2 + 2AgNO_3 \rightarrow 2AgCl + Ba(NO_3)_2$ formulae (1) balance(1)	3

Question	Answer	Marks
5(a)	C_nH_{2n} (1)	**1**
5(b)	C_5H_{10} (1)	**1**
5(c)	E (1) it has the longest carbon chain (1)	**2**
5(d)	A (1) it has the lowest M_r (1)	**2**
5(e)	orange to colourless (1) structure of 1,2-dibromobutane (1)	**2**
5(f)(i)	structure of propan-1-ol (1) structure of propan-2-ol (1) 	**2**
5(f)(ii)	steam (1) catalyst (1) one other condition: either 60 atm pressure **OR** 300 °C (1)	**3**
5(g)(i)	addition	**1**
5(g)(ii)	poly(but-1-ene)	**1**

Question	Answer	Marks
5(g)(iii)	**M1** 2 C atoms (only) with a single bond between them linked to the continuation bonds shown **M2** correct repeat unit showing one C_2H_5 / CH_2CH_3 side chain attached to one of the C atoms in **M1** **M3** correct use of ‘n’	**3**
5(g)(iv)	CH_2	**1**