Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

CHEMISTRY **9701/23**

Paper 2 AS Level Structured Questions **May/June 2019**

MARK SCHEME

Maximum Mark: 60

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:

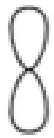
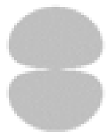
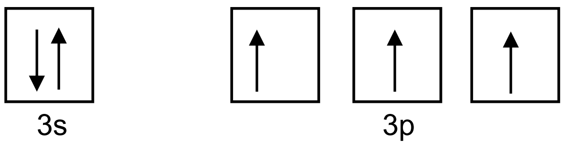
Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

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)(i)	All have the same nucleon number OR same sum / **total** number of protons + neutrons	1
1(a)(ii)	(different) number of protons, neutrons **and** electrons	1
1(b)	**M1** $x / 100 \times 32 + (100 – x / 100 \times 34) = 32.09$ **M2** $(32x + 3400 – 34x) = 3209$ so $x = 95.5$ **M3** S^{32} 95.5% **AND** S^{34} 4.5%	3
1(c)(i)	1s	1
1(c)(ii)	 OR 	1
1(c)(iii)	**M1** 3p **M2** It is less attracted to the nucleus (so takes less energy to lose) OR It is the highest energy orbital (which is occupied) / it is in the highest energy orbital	2
1(d)(i)		1
1(d)(ii)	**M1** (in S, the electron is removed from the) 2 electrons in (3)**p** orbital OR a pair of electrons in (3)**p** (orbital / sub-shell) **M2** (paired electrons) repel	2

Question	Answer	Marks
2(a)(i)	held in regular / uniform arrangement	**1**
2(a)(ii)	**M1** covalent (bonds) AND (temporary) induced dipoles **M2** (temporary) induced dipoles	**2**
2(b)(i)	2	**1**
2(b)(ii)	iodine (atom / s) donates a pair of electrons (to the A*l*-I covalent bond / s).	**1**
2(c)(i)	$2H_2SO_4 + 14HI \rightarrow 7I_2 + 8H_2O + H_2S + S$ **M1** correct species **M2** correctly balanced equation	**2**
2(c)(ii)	*explain with ref to ox no's why the reaction in **(c)(i)** is a redox reaction* **M1** I (oxidation number increases) from –1 to 0 = oxidation / reducing agent **M2** S (oxidation number decreases) from (+) 6 to 0 **OR** –2 = reduction / oxidising agent	**2**

Question	Answer	Marks
3(a)	white light / flame **AND** (produces a) white / grey solid / ash / powder / smoke	**1**
3(b)(i)	$MgO + 2HCl \rightarrow MgCl_2 + H_2O$	**1**
3(b)(ii)	neutralisation	**1**
3(c)	**M1** giant (structure / lattice) **M2** (so) lots of energy needed to break the bonds OR strong bonds	**2**
3(d)(i)	$MgCO_3(s) \rightarrow MgO(s) + CO_2(g)$	**1**
3(d)(ii)	(thermal) decomposition	**1**

Question	Answer	Marks
4(a)	**M1** sulfur impurities OR sulfur in fossil fuels **M2** converted into SO_2 by combustion / burning sulfur **OR** heat sulfur with oxygen (from the air)	**2**
4(b)(i)	**M1** 1 mol SO_2 → 1 mol H_2SO_4 64.1 g / tonne → 98.1 g / tonne **M2** SO_2 → 98.1 / 64.1 × 1590 = 2433.369735 tonnes	**2**
4(b)(ii)	high (enough) temperature / (a lot of) heat (energy) is produced **AND** to break (strong) triple bond in N_2 / break N≡N **AND** nitrogen (and oxygen) from the air / atmosphere react Award two marks for three correct points Award one mark for two correct points	**2**
4(b)(iii)	lightning	**1**
4(b)(iv)	**M1** nitrogen dioxide increases the rate **OR** lowers the activation energy **M2** (NO_2) is regenerated by reaction of NO with O_2 (in the air) **OR** NO (formed) reacts with O_2 (in air) to (re)form NO_2	**2**

Question	Answer	Marks
5(a)(i)	pentanenitrile	**1**
5(a)(ii)	a lone pair / electron pair donor	**1**
5(a)(iii)	(:)CN^- / $^-$(:)CN / cyanide ion	**1**
5(a)(iv)	Br (atom) is replaced (with / by CN / nitrile)	**1**
5(b)	**M1** *reagent* Ammonia **M2** *conditions* heat with under pressure / heat in a sealed tube	**2**
5(c)(i)	**M1** Increasing reactivity from C*l* → Br → I **M2** Due to decreasing strength of C-X bond (from C-C*l* to C-Br to C-I) OR Less energy needed to break C-X (from C-C*l* to C-Br to C-I)	**2**
5(c)(ii)	**M1** tertiary / 3° halogenoalkane **M2** (carbo)cation / intermediate is stable **M3** due to (3) electron releasing/donating methyl groups / + I groups (attached to central C) OR (positive) inductive effect of the (three) methyl groups /	**3**
5(c)(iii)	*Any* **formula / name** for *any* **primary** halogenoalkane i.e. 1-chlorobutane / 1-bromobutane / 1-iodobutane	**1**

Question	Answer	Marks
6(a)(i)	Orange / brown **to** colourless / decolourises	**1**
6(a)(ii)	any non-ambiguous structures of:	
	X $(CH_3)_2C = CH_2$ / $(CH_3)_2CCH_2$	**1**
	Y $CH_3CH_2CH = CH_2$ / $C_2H_5CHCH_2$	**1**
	Z $CH_3CH = CHCH_3$ / $CH_3CHCHCH_3$	**1**
6(a)(iii)	C_4H_8	**1**
6(b)(ii)	V = primary / 1° alcohol	**1**
	W = tertiary / 3° alcohol	**1**
6(b)(ii)	$CH_3(CH_2)_2CH_2OH + Na \rightarrow CH_3(CH_2)_2CH_2ONa + ½ H_2$	**1**
6(b)(iii)	**M1** Reagent H^+ / $Cr_2O_7^{2-}$ **M2** Observations for V orange to green **M3** Observations for W no change / remains orange	**3**