Cambridge Assessment International Education

Cambridge IGCSE™

CHEMISTRY **0620/31**

Paper 3 Theory (Core) **October/November 2022**

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 2022 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

This document consists of **10** printed pages.

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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.

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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.

Science-Specific Marking Principles

1	Examiners should consider the context and scientific use of any keywords when awarding marks. Although keywords may be present, marks should not be awarded if the keywords are used incorrectly.
2	The examiner should not choose between contradictory statements given in the same question part, and credit should not be awarded for any correct statement that is contradicted within the same question part. Wrong science that is irrelevant to the question should be ignored.
3	Although spellings do not have to be correct, spellings of syllabus terms must allow for clear and unambiguous separation from other syllabus terms with which they may be confused (e.g. ethane / ethene, glucagon / glycogen, refraction / reflection).
4	The error carried forward (ecf) principle should be applied, where appropriate. If an incorrect answer is subsequently used in a scientifically correct way, the candidate should be awarded these subsequent marking points. Further guidance will be included in the mark scheme where necessary and any exceptions to this general principle will be noted.
5	‘List rule’ guidance For questions that require ***n*** responses (e.g. State **two** reasons …): • The response should be read as continuous prose, even when numbered answer spaces are provided. • Any response marked *ignore* in the mark scheme should not count towards ***n***. • Incorrect responses should not be awarded credit but will still count towards ***n***. • Read the entire response to check for any responses that contradict those that would otherwise be credited. Credit should **not** be awarded for any responses that are contradicted within the rest of the response. Where two responses contradict one another, this should be treated as a single incorrect response. • Non-contradictory responses after the first ***n*** responses may be ignored even if they include incorrect science.

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6 Calculation specific guidance

Correct answers to calculations should be given full credit even if there is no working or incorrect working, **unless** the question states 'show your working'.

For questions in which the number of significant figures required is not stated, credit should be awarded for correct answers when rounded by the examiner to the number of significant figures given in the mark scheme. This may not apply to measured values.

For answers given in standard form (e.g. $a \times 10^n$) in which the convention of restricting the value of the coefficient (a) to a value between 1 and 10 is not followed, credit may still be awarded if the answer can be converted to the answer given in the mark scheme.

Unless a separate mark is given for a unit, a missing or incorrect unit will normally mean that the final calculation mark is not awarded. Exceptions to this general principle will be noted in the mark scheme.

7 Guidance for chemical equations

Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.

State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.

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Question	Answer	Marks
1(a)(i)	B	**1**
1(a)(ii)	G	**1**
1(a)(iii)	C	**1**
1(a)(iv)	D	**1**
1(a)(v)	A	**1**
1(b)(i)	one mark each for any 2 of: • breakdown of long chain hydrocarbons / breakdown of large hydrocarbons • to short chain hydrocarbons / to small hydrocarbons • by heat / when heated / thermal (energy)	**2**
1(b)(ii)	C_5H_{10}	**1**

Question	Answer	Marks
2(a)(i)	5(%)	**1**
2(a)(ii)	iron	**1**
2(a)(iii)	one mark each for any 2 of: • more iron in whole / less iron in crust • more magnesium in whole / less magnesium in crust • less oxygen in whole / more oxygen in crust • less silicon in whole / more silicon in crust	**2**
2(b)	2 electrons in outer shell (1) 2,8,8 in inner shells (1)	**2**
2(c)(i)	hematite (1)	**1**

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Question	Answer	Marks
2(c)(ii)	2 (Fe) (1) 3 (CO_2) (1)	**2**
2(c)(iii)	breakdown of a compound (1) by heat / when heated / using thermal energy (1)	**2**
2(c)(iv)	3rd box down ticked (it reacts with impurities in the iron ore to form slag)	**1**
2(c)(v)	less iron ore mined / conserves iron ore / less energy used to produce iron / conserves fuels	**1**

Question	Answer	Marks
3(a)	coal / coke / wood	**1**
3(b)	L	**1**
3(c)	exothermic	**1**
3(d)	carbon dioxide (1) water (1)	**2**
3(e)(i)	^{235}U	**1**
3(e)(ii)	testing for leaks in pipes / measuring paper thickness	**1**

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Question	Answer	Marks
4(a)(i)	melting point of chlorine: values between –10 and – 210 (inclusive of these values) (1) density of fluorine: values lower than 0.003 (inclusive of this value) but not below 0.0001 (1)	**2**
4(a)(ii)	gas (1) 0 °C higher than the boiling point / the boiling point is below 0 °C (1)	**2**
4(b)(i)	2 (F_2) (1) 4 (HF) (1)	**2**
4(b)(ii)	gain of oxygen / addition of oxygen	**1**
4(c)	1 mark each for any 3 of: • bromine particles escape from liquid • diffusion • particles in (constant) movement / particles collide • (movement of particles) is random / in every direction • particles spread out • particles (spread) from higher concentration to lower concentration	**3**

Question	Answer	Marks
5(a)	potassium (1) phosphorus (1)	**2**
5(b)	calcium chloride (1) water (1)	**2**

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Question	Answer	Marks
5(c)	(add dilute nitric acid and) silver nitrate (1) white precipitate (1)	**2**
5(d)(i)	vehicle engines / high temperature furnaces / lightning	**1**
5(d)(ii)	breathing difficulties / asthma	**1**

Question	Answer	Marks
6(a)	*Products (max 2 marks)* 1 mark each for any of: • zinc chloride (for zinc and zinc oxide) • reaction with Zn gives off hydrogen • reaction with ZnO gives water *Observations (max 2 marks)* *with zinc* • bubbles / effervescence • zinc disappears / zinc gets smaller *with zinc oxide* • zinc oxide disappears / zinc oxide gets smaller	**4**
6(b)(i)	1.0 2.0 0.5	**1**
6(b)(ii)	takes longer / time increases	**1**
6(c)	pH 12	**1**

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Question	Answer	Marks
6(d)	yellow (1) to red / pink (1)	**2**
6(e)(i)	crops / plants don't grow well if pH acidic	**1**
6(e)(ii)	calcium carbonate / calcium oxide / slaked lime	**1**
6(f)	1 mark each for any two of: • evaporate to point of crystallisation / heat to point of crystallisation / evaporate some of the water and leave (to crystallise) / heat to form a saturated solution (then leave) (1) • filter crystals / pick out crystals (1) • dry with filter paper / dry in drying oven	**2**

Question	Answer	Marks
7(a)(i)	circle around OH attached to middle carbon atom	**1**
7(a)(ii)	$C_3H_6O_3$	**1**
7(b)(i)	ethene	**1**
7(b)(ii)	1 mark each for any two of: • anaerobic / no oxygen • yeast • room temperature / quoted values between 10 °C and 40 °C (inclusive) • pH neutral / pH 7	**2**
7(b)(iii)	solvent	**1**
7(b)(iv)	melting point / boiling point	**1**
7(c)	compounds with similar chemical properties (1) same functional group (1)	**2**

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Question	Answer	Marks
8(a)	one mark each for any two of: • nickel has high(er) density or reverse argument for sodium • nickel forms coloured compounds or reverse argument for sodium • nickel hard(er) or reverse argument for sodium	**2**
8(b)(i)	anode	**1**
8(b)(ii)	pure nickel rod gets smaller (1) spoon gets silvery / shiny / shinier(1)	**2**
8(b)(iii)	makes object more attractive / makes object more resistant to corrosion / makes object (surface) harder	**1**
8(c)	electrons = 28 (1) neutrons = 34 (1)	**2**
8(d)	171 (2) If two marks not scored, allow 1 mark for C = 4 × 12 / 48 OR O = 4 ×16 / 64	**2**
8(e)	tin < nickel < magnesium < sodium (2) IF two marks not scored, 1 mark for one adjacent pair reversed.	**2**

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