CAMBRIDGE
International Education

Cambridge O Level

CHEMISTRY **5070/21**

Paper 2 Theory **October/November 2024**

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 2024 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

 [Turn over

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 descriptions 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.

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.

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.

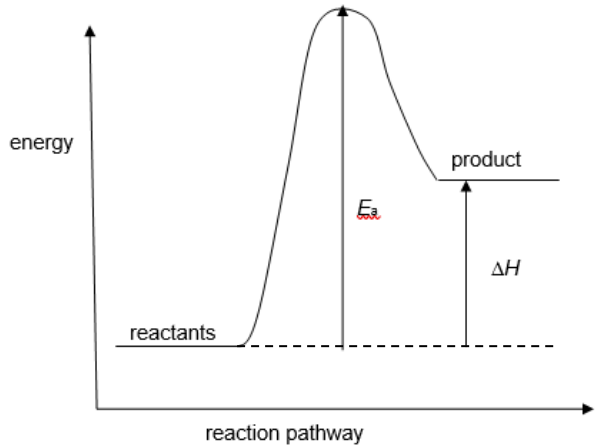
7 Guidance for chemical equations

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.

Question	Answer	Marks
1(a)(i)	**G**	**1**
1(a)(ii)	**H**	**1**
1(a)(iii)	**F**	**1**
1(a)(iv)	**E**	**1**
1(a)(v)	**D**	**1**
1(b)	(number of protons) 24 (1) (number of neutrons) 29 (1)	**2**

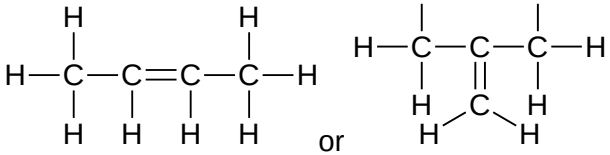
Question	Answer	Marks
2(a)(i)	oxidation **and** reduction occur **simultaneously**	**1**
2(a)(ii)	CO removes oxygen **from** iron oxide / CO gains oxygen **from** the iron oxide	**1**

Question	Answer	Marks
2(b)	 **M1** reactants to left and products to right and reactant level below product level (1) **M2** activation energy hump between reactants and products and almost vertical upward arrow from reactant energy level to top of energy hump labelled activation energy (1) **M3** enthalpy change shown between reactants and products as upward arrow labelled enthalpy change (1)	**3**
2(c)	calcium oxide reacts with silicon(IV) oxide / sand / or impurities in the ore or SiO_2 (1) $CaO + SiO_2 \rightarrow CaSiO_3$ (1)	**2**

Question	Answer	Marks
2(d)	**Any two from:** have high density / more dense (1) high melting point / boiling point (1) variable oxidation numbers (1) act as a catalyst (1) not as reactive (1) hard (1)	**2**
2(e)(i)	equilibrium shifts to the right (1) greater number of moles of **gas** on the right of the equation / greater volume of **gas** on the right of the equation (1)	**2**
2(e)(ii)	open system / open container / container not closed / let CO escapes (1) (open container / removing CO) shifts equilibrium (continuously) to the right (1)	**2**
2(f)	$2Fe + 6H_2SO_4 \rightarrow Fe_2(SO_4)_3 + 3SO_2 + 6H_2O$ correct formulae (1) correct balancing (1)	**2**

Question	Answer	Marks
3(a)	right hand electrode labelled	**1**
3(b)	the ions can move / the ions are mobile	**1**
3(c)(i)	hydrogen	**1**

Question	Answer	Marks
3(c)(ii)	$2Cl^- \rightarrow Cl_2 + 2e^-$	**1**
3(d)	unreactive / inert	**1**
3(e)	sodium	**1**

Question	Answer	Marks
4(a)	**Any two from:** same functional group (1) trend in physical properties (1) same general formula (1)	**2**
4(b)(i)	not all the carbon-carbon bonds are single / there is a double carbon-carbon bond	**1**
4(b)(ii)	$CH_3CH_2CH{=}CH_2$	**1**
4(b)(iii)	 or	**1**
4(c)(i)	jet fuel	**1**
4(c)(ii)	$C_{11}H_{24} \rightarrow C_4H_{10} + C_3H_6 + 2C_2H_4$ correct formulae (1) balancing (1)	**2**
4(d)(i)	hydrogen chloride	**1**

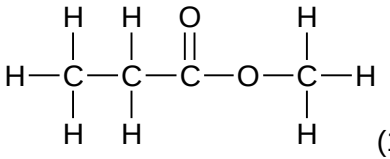
Question	Answer	Marks
4(d)(ii)	ultraviolet light	**1**
4(e)(i)	energy associated with bond breaking 612 + 193 **OR** 805 (1) energy associated with bond forming = 347 + 2(290) **OR** 927 (1) (enthalpy change = + 805 – 927) = –122 (kJ / mol) (1)	**3**
4(e)(ii)	orange to colourless	**1**

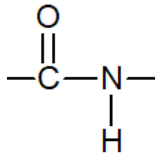
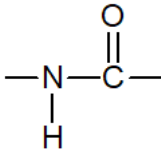
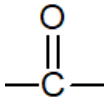
Question	Answer	Marks
5(a)	$CuCl_2(aq) + H_2O(l) + CO_2(g)$	**1**
5(b)(i)	initial gradient steeper and line starts at 200.0 (1) line is curved and ends at same final mass (1)	**2**
5(b)(ii)	rate increases / reaction is faster because (no mark) particles are more crowded / distance between particles is smaller / more particles per unit volume (1) more collisions per second / greater collision frequency (1)	**2**
5(c)	moles $HCl = 0.500 \times \frac{22.0}{1000}$ **OR** 0.011 (1) moles $CO_2 = 5.5 \times 10^{-3}$ **OR** $\frac{0.011}{2}$ (1) volume of carbon dioxide = 0.13 (dm^3) (1)	**3**

Question	Answer	Marks
5(d)(i)	(light) blue precipitate (1) (dissolves to form) dark blue solution (1)	**2**
5(d)(ii)	**+**1	**1**
5(e)	**Any three from:** titrate (aqueous ammonia with hydrochloric acid) (1) repeat titration without indicator (1) evaporate filtrate to crystallisation point / heat until saturated solution formed (1) leave / cool and filter or leave / cool and dry (1)	**3**

Question	Answer	Marks
6(a)(i)	there are no mobile electrons	**1**
6(a)(ii)	high melting point	**1**
6(b)	weak intermolecular forces	**1**
6(c)	one pair of electrons in each overlap area **AND** two lone pairs on each sulfur atom **AND** 6 unpaired electrons on each chlorine atom	**1**

Question	Answer	Marks
6(d)	(moles of S_2Cl_2 =) 13.5 / 135 **OR** 0.100 (1) (moles of H_2O =) 8.00 / 18) **OR** 0.444 (1) moles of H_2O needed = 0.300 / moles of S_2Cl_2 that would react = 0.148 (1)	**3**
6(e)(i)	acid rain	**1**
6(e)(ii)	**Any two from:** flue gas desulfurisation / (reacting sulfur dioxide with) calcium oxide / (reacting sulfur dioxide with) calcium carbonate (1) use low-sulfur fuels (1) burn or use less fossil fuels / do not use fossil fuels / use renewable energy sources / use named renewable energy sources such as solar etc.	**2**

Question	Answer	Marks
7(a)(i)	methyl propanoate (1)  (1)	**2**
7(a)(ii)	proton is transferred from the acid to water (1) the reaction does not go to completion / the acid is not fully dissociated / the acid is not fully ionised (1)	**2**
7(a)(iii)	magnesium propanoate (1) hydrogen (1)	**2**

Question	Answer	Marks
7(a)(iv)	motion: only vibrates (1) separation: touching (1)	**2**
7(b)(i)	 and/or  **M1** link between all 4 boxes (1) **M2** amide linkages in correct direction (1) **M3** left hand box ends  and right hand box ends with  (1)	**3**
7(b)(ii)	large molecules (1) built up from **many** smaller molecules / built up from **many** monomers (1)	**2**
7(b)(iii)	**Any one from:** no small molecule eliminated in addition polymerisation / small molecule eliminated in condensation polymerisation (1) only one product in addition polymerisation / biproduct in condensation polymerisation (1) addition polymer has same empirical formula as the monomer / condensation polymer does not have same empirical formula as the monomer (1) addition polymer made from monomers with a C=C bond / condensation polymerisation uses monomers with two functional groups (1)	**1**