CAMBRIDGE
International Education

Cambridge O Level

CHEMISTRY **5070/22**

Paper 2 Theory **May/June 2025**

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 2025 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

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	<u>'List rule' guidance</u> 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.

Annotations guidance for centres

Examiners use a system of annotations as a shorthand for communicating their marking decisions to one another. Examiners are trained during the standardisation process on how and when to use annotations. The purpose of annotations is to inform the standard isation and monitoring processes and guide the supervising examiners when they are checking the work of examiners within their team. The meaning of annotations and how they are used is specific to each component and is understood by all examiners who mark the component.

We publish annotations in our mark schemes to help centres understand the annotations they may see on copies of scripts. Note that there may not be a direct correlation between the number of annotations on a script and the mark awarded. Similarly, the use of an annotation may not be an indication of the quality of the response.

The annotations listed below were available to examiners marking this component in this series.

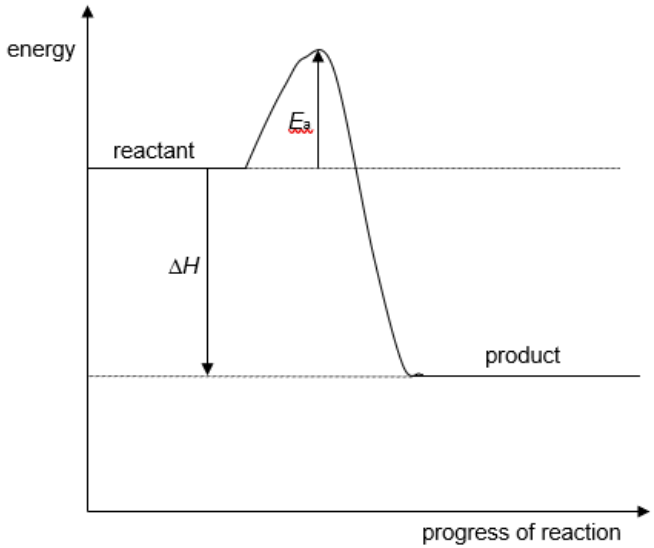
Annotations

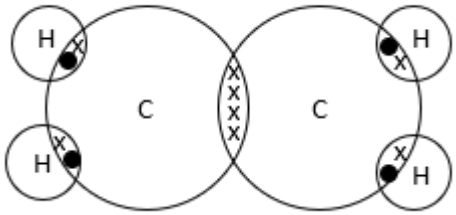
Annotation	Meaning
	correct point or mark awarded
	incorrect point or mark not awarded
	information missing or insufficient for credit
	incorrect or insufficient point ignored while marking the rest of the response
	contradiction in response, mark not awarded
	benefit of the doubt given
	error carried forward applied
	benefit of doubt was considered, but the response was decided to not be sufficiently close for benefit of doubt to be applied .
	incorrect point or mark not awarded
	rounding error

Annotation	Meaning
SEEN	point has been noted, but no credit has been given or blank page seen
SF	error in number of significant figures
	pages are linked together
	used to highlight part of the response
	key point attempted / working towards marking point / incomplete answer / response seen but not credited / blank page seen
	unclear response / query

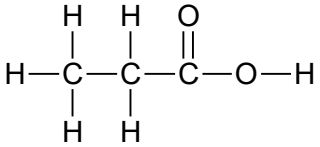
Question	Answer	Marks
1(a)	silver chloride	1
1(b)	sodium bromide	1
1(c)	potassium manganate(VII)	1
1(d)	barium chloride	1
1(e)	potassium iodide	1

Question	Answer	Marks
2(a)(i)	**M1** giant (covalent) structure **M2** has (many) strong covalent bonds / (many) covalent bonds that needs lots of energy to break	2
2(a)(ii)	(high) electrical conductivity	1
2(b)	(anode) oxygen (and water) / O_2 (and H_2O) (1) (cathode) hydrogen / H_2 (1)	2
2(c)	(anode) $2O^{2-} \rightarrow O_2 + 4e^-$ / $2O^{2-} - 4e^- \rightarrow O_2$ (1) (cathode) $Al^{3+} + 3e^- \rightarrow Al$ (1)	2
2(d)	(anode) (pure) copper (1) (electrolyte) aqueous copper(II) sulfate (1)	2

Question	Answer	Marks
3(a)	orange to colourless	1
3(b)	energy associated with bond breaking = 610 + 193 **OR** 803 (1) energy associated with bond forming = 350 + 560 **OR** 910 (1) enthalpy change = 803 – 910 = (–107 kJ/mol) (1)	3
3(c)	 **M1** reactants to left and products to right and reactant level above product level **M2** enthalpy change shown between reactants and products as downward arrow labelled enthalpy change **M3** activation energy hump between reactants and products and almost vertical upward arrow from reactant energy level to top of energy hump labelled activation energy	3

Question	Answer	Marks
3(d)	 **M1** double bond between C—C shown **M2** each carbon to have two C—H bonds shown	**2**

Question	Answer	Marks
4(a)	$C_nH_{2n+1}COOH$ / $C_nH_{2n+1}CO_2H$	**1**
4(b)	have the same functional group	**1**
4(c)(i)	calcium <u>ethanoate</u>	**1**
4(c)(ii)	moles of calcium = 1.35 / 40 **OR** 0.03375 (1) moles of hydrogen = 0.03375 (1) volume of hydrogen = 0.81 (dm^3) (1)	**3**
4(d)	**M1** (starting material is aqueous) ethanol **M2** (reactant) reacts with oxygen **M3** (conditions) presence of bacteria	**3**
4(e)(i)	$C_4H_8O_2$	**1**

Question	Answer	Marks
4(e)(ii)		1
4(e)(iii)	bubbles / fizzing / effervescence / forms a colourless solution	1
4(e)(iv)	sodium butanoate **and** water	1

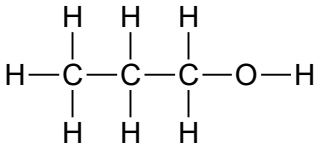
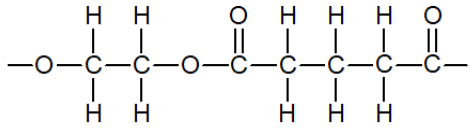
Question	Answer	Marks
5(a)(i)	$C_{12}H_{26} + 18½O_2 \rightarrow 12CO_2 + 13H_2O$	1
5(a)(ii)	global warming / climate change	1
5(a)(iii)	**M1** fractional distillation / use of a fractionating column **M2** petroleum is heated / petroleum is vapourised / petroleum is boiled **M3** diesel collected at its boiling point / separation because of different boiling points	3
5(b)(i)	acid rain	1
5(b)(ii)	$CaSO_3$	1
5(b)(iii)	rate increases **particles** move faster / **particles** have more **kinetic** energy (1) more successful collisions / more effective collisions / more collisions with energy above that of the activation energy / more particles with energy above activation energy (1)	2

Question	Answer	Marks
5(b)(iv)	rate decreases surface area (to volume ratio) decreases / fewer exposed particles (1) less frequent collisions / lower collision frequency / collisions less often / less collisions per second (1)	2

Question	Answer	Marks
6(a)(i)	−50 °C is lower than melting point	1
6(a)(ii)	particles are touching each other / particles are very close to one another (1) particles are in a pattern / arrangement is ordered (1) particles are vibrating (1)	3
6(b)	moles of bromine = 40 **OR** $2.408 \times 10^{25} / 6.02 \times 10^{23}$ (1) mass of bromine = 6400 (g) (1)	2
6(c)(i)	$Br_2 = 0$ (1) $Br^- = -1$ (1)	2
6(c)(ii)	bromine gains electrons	1
6(d)(i)	position of equilibrium moves to the left / position of equilibrium moves to the reactants side (1) because (forward) reaction is exothermic / because the backward reaction is endothermic (1)	2
6(d)(ii)	**M1** no effect / no change / stays the same **M2** same (number of) moles of **gas** on each side of the equation / equal volumes of **gas** on each side of equation	2

Question	Answer	Marks
6(e)	<table><tr><td></td><td>phosphorus</td><td>bromine</td></tr><tr><td>%</td><td>7.2</td><td>92.8</td></tr><tr><td>number of moles</td><td>0.232</td><td>1.16</td></tr></table> correct percentage for bromine (1) correct number of moles (1) empirical formula stated as PBr_5 (1)	3

Question	Answer	Marks
7(a)	hard	1
7(b)	**mixture** of a metal with other elements	1
7(c)	**Any three from:** **M1** zinc forms a **protective** layer / zinc forms a barrier **M2** (barrier) to prevent oxygen reaching (surface of) iron / to prevent water reaching (surface of) iron **M3** zinc more reactive (than iron) **M4** zinc corrodes in preference (to iron)	3
7(d)	$2Fe(s) + 3H_2SO_4(aq) \rightarrow Fe_2(SO_4)_3(aq) + 3H_2(g)$ balanced equation (1) all correct formulae with correct state symbols (1)	2

Question	Answer	Marks
8(a)(i)	all carbon-carbon bonds are single bonds	1
8(a)(ii)	contains the O—H functional group	1
8(a)(iii)	contains the -COO- linkage	1
8(b)	have the same molecular formula but different structures	1
8(c)(i)	acidic	1
8(c)(ii)	propan-1-ol (1)  (1)	2
8(d)(i)	 one correct repeat unit (1) continuation bonds (1)	2
8(d)(ii)	there is a by-product formed during condensation polymerisation / the polymer and water are made	1