

Cambridge O Level

CHEMISTRY**5070/22**

Paper 2 Theory

May/June 2026**MARK SCHEME**Maximum Mark: 80

Published

This mark scheme contains the instructions and marking guidance that our examiners used to mark candidate responses for this component.

Before they start marking, examiners complete a standardisation process. They review a range of candidate responses and discuss the mark scheme in detail to agree which answers can and cannot be accepted. Examiners award marks where it is clear that candidate responses have met the requirements of the mark scheme. These requirements may vary between different components or different versions of the same component, depending on the exact requirements of the question and the candidate responses seen during the standardisation process.

Sometimes, our mark schemes may allow marks to be awarded to responses which contain elements that are factually incorrect or for content not covered by the syllabus. We do this in response to the demands of a specific question to support candidates and make sure that our assessments are fair. However, these allowances should not be used as a guide for teaching and learning.

We cannot discuss the mark scheme with schools, and we recommend that schools read the mark scheme together with the assessment material and the Principal Examiner Report for Teachers.

This document consists of **28** printed pages.

General marking principles

All examiners must apply these marking principles when marking candidate responses.

1	Examiners must award marks for each response in line with: - the specific content defined in the mark scheme - the specific skills defined in the mark scheme or in the level descriptions - the standard of response required as exemplified by the standardisation scripts.
2	Examiners must award whole marks (not half marks, or other fractions).
3	Examiners must award marks positively . This means that: - marks are not deducted for errors or omissions - marks are awarded for correct/valid answers as defined in the mark scheme and also for other valid answers which go beyond the scope of the syllabus and mark scheme referring to your team leader as appropriate - the quality of spelling, punctuation and grammar are judged only when the mark scheme indicates that these features are specifically assessed in the question. However, the meaning of all responses must be unambiguous.
4	Examiners must consistently apply the requirements of the mark scheme and any rules for what to do when candidates have not followed instructions correctly.
5	Examiners must use the full range of marks defined in the mark scheme, unless limited by the quality of the candidate responses seen.
6	Examiners must award marks according to the mark scheme and must not award marks with grade thresholds or grade descriptions 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 <i>n</i> responses (e.g. State two reasons ...): • The response should be read as continuous prose, even when numbered answer spaces are provided. • Any response marked <i>ignore</i> in the mark scheme should not count towards <i>n</i>. • Incorrect responses should not be awarded credit but will still count towards <i>n</i>. • 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 <i>n</i> 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 standardisation 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
	incorrect point or mark not awarded
	rounding error

Annotation	Meaning
	point has been noted, but no credit has been given or blank page seen
	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

Abbreviations used within Mark Scheme

Abbreviation	Meaning
ECF	error carried forward
ORA	Or reverse argument
CON	contradiction in response, mark not awarded

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Question	Answer	Marks	Guidance
1	In Question 1 allow the correct name but the correct formula takes precedence. In Question 1 ignore errors in case and even the formula if it clearly identifies the correct answer from the list e.g. AL2O2		
1(a)	Al_2O_3	1	ALLOW aluminium oxide
1(b)	H_2	1	ALLOW hydrogen / H
1(c)	NH_3	1	ALLOW ammonia
1(d)	Al_2O_3	1	ALLOW aluminium oxide / Al
1(e)	C_3H_8	1	ALLOW propane

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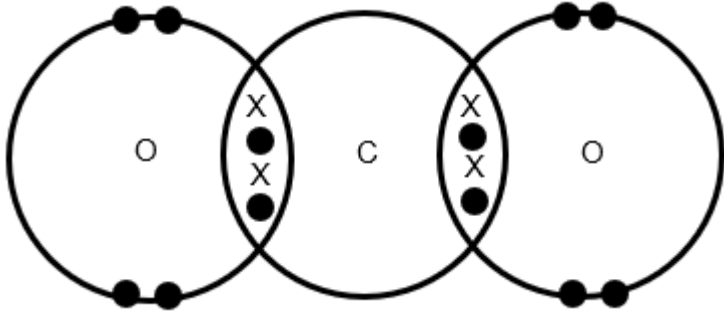
Question	Answer	Marks	Guidance
2(a)	M1 moles of $\text{KO}_2 = 13.0 / 71$ OR 0.18310 (1) M2 mols of $\text{O}_2 = 0.75 \times 13.0 / 71$ OR 0.75×0.18310 OR 0.13732 (1) M3 vol of $\text{O}_2 = 3.30$ (dm^3) (1)	3	FIRST LOOK AT FINAL ANSWER • IF any value in the range 3.29 and 3.50 and three sig figs = 3 MARKS • IF any value in the range 3.29 and 3.50 but not three sig figs = 2 MARKS • IF 0.13732 = 2 MARKS • IF any value in the range 4.32 and 4.39 and three sig figs = 2 MARKS • IF any value in the range 0.822 to 0.875 and three sig figs = 2 MARKS • IF 5.86 = 2 MARKS • IF 0.18310 = 1 MARKS NOTE any value from two sig figs or above including truncation ALLOW correct number string NOTE any value from two sig figs or above including truncation ALLOW ECF from M1 NOTE for M3 must be three sig figs but allow truncation ALLOW ECF from M2
2(b)	O_2^-	1	ALLOW $\text{K}^+ \text{O}_2^-$ but REJECT KO_2^- ALLOW 2O_2^-, etc.

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Question	Answer	Marks	Guidance
2(c)	regular arrangement of (alternating) positive and negative ions	1	ALLOW ordered structure with (alternating) positive and negative ions ALLOW regular arrangement of oppositely charged ions ALLOW regular arrangement of cations and anions ALLOW geometrical arrangement or pattern for regular arrangement ALLOW rows or layers of (alternating) positive and negative ions ALLOW reference to negative oxygen ions NOTE ions held together by electrostatic attraction can be taken to mean both positive and negative ions IGNORE giant lattice this is given in the question REJECT reference to macromolecules, molecules, covalent, atoms or intermolecular forces

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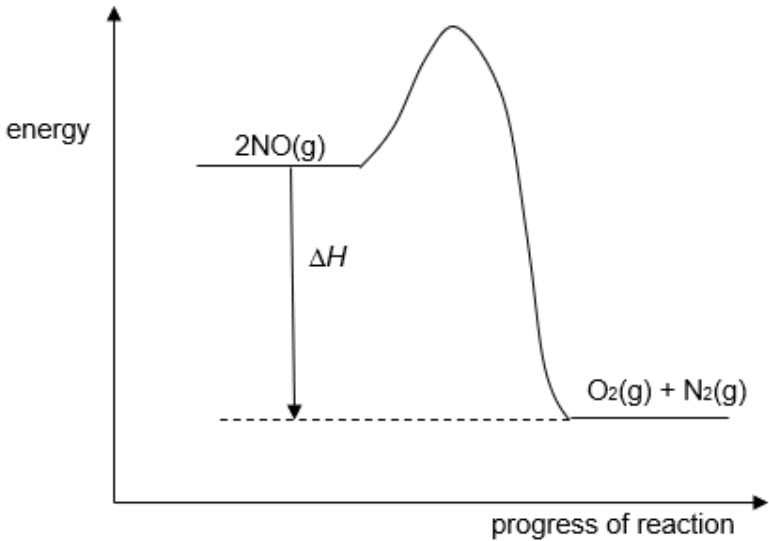
Question	Answer	Marks	Guidance
2(d)	M1 particles are touching each other (1) M2 regular arrangement / ordered arrangement (1) M3 vibrating (about a fixed point) (1)	3	ALLOW reference to atoms, molecules, ions or ‘they’ rather than particles ALLOW particles are close (packed) / particles are tightly packed for M1 REJECT little or no separation between particles / little or no space between particles for M1 REJECT small space between particles for M1 ALLOW particles are in a pattern for M2 ALLOW particles are in a lattice for M2 ALLOW particles are in a uniform arrangement for M2 IGNORE particles in a fixed position or fixed arrangement for M2 and M3 IGNORE rotation for M3 REJECT any reference to translational motion for M3

Question	Answer	Marks	Guidance
2(e)	 M1 two double bonds shown (1) M2 lone pairs on oxygen correct (1)	2	ALLOW all white dots, all black dots, all crosses or a mixture of black, white dots, and/or crosses IGNORE any inner shells shown IGNORE missing symbols NOTE lone pairs do not need to be shown as pairs REJECT additional non-bonded electrons for M2

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Question	Answer	Marks	Guidance
2(f)	weak intermolecular forces	1	ALLOW attraction for force throughout ALLOW easy to overcome forces between molecules / needs little energy to break intermolecular or attraction between molecules NOTE easier to overcome forces / less energy to overcome intermolecular forces / low(er) intermolecular forces is not sufficient ALLOW weak bonds between molecules / weak intermolecular bonds / (weak) van der Waals' forces (between molecules) / weak VDW forces IGNORE does not have strong intermolecular forces / less intermolecular forces / weaker intermolecular forces / little intermolecular forces NOTE weak intermolecular / simple molecular / simple covalent / weak forces between particles are not sufficient REJECT weak covalent bonds / weak forces between atoms / intermolecular forces between atoms REJECT intermolecular forces between bonds / strong intermolecular forces / intramolecular forces REJECT macromolecule or giant molecule / reference to ions

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Question	Answer	Marks	Guidance
3(a)	 labels on axes (1) reactants above products and reactants on the left (1) downward arrow labelled as ΔH (1)	3	ALLOW enthalpy for energy / energy level for y-axis IGNORE kJ / kJ mol⁻¹ REJECT energy change / enthalpy change / KE / PE for y-axis ALLOW reaction coordinate / reaction pathway for x-axis REJECT time / rate of reaction / reaction procession for x-axis / s ALLOW words reactant and products / R and P / NO for reactant and either O₂ or N₂ for product NOTE words take precedence over formulae NO, N₂ and O₂ NOTE if double headed arrow or no arrow must indicate that it is negative, e.g. ΔH –ve ALLOW ECF from M2 (endothermic reaction) IGNORE activation energy arrow and curve
3(b)	activation energy is lowered	1	ALLOW E_a is lowered NOTE active energy is not sufficient but ALLOW activational energy IGNORE references to collisions

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Question	Answer	Marks	Guidance
3(c)	idea of maximising the amount of NO removed (from exhaust gases)	1	ALLOW more NO reacts / less NO comes out of exhaust ALLOW reference to toxic gas or CO instead of NO ALLOW to have a fast reaction / so the rate of reaction is very high ALLOW to increase the rate of reaction / to have a faster reaction / is more efficient ALLOW more particles exposed (to catalyst) / more collisions per second (with catalyst) / high number of collisions per second NOTE more collisions or more successful collision / more collisions involving collisions with more energy than activation energy / more chance of collision are not sufficient IGNORE idea of catalyst reacting

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Question	Answer	Marks	Guidance
3(d)	M1 particles are more crowded / distance between particles is smaller / more particles per unit volume (1) M2 more collisions per second / greater collision frequency (1)	2	NOTE marking points are all comparative IGNORE references to equilibrium ALLOW atom, ion or molecule for particle ALLOW more particles in the same space / more particles in the same area / more particles per dm³ / more concentrated particles / particles closer together / particles come closer together IGNORE particles take up less space REJECT particles have more kinetic energy / particles are moving faster / activation energy changes for M1 ALLOW collisions more often / increased collision rate IGNORE more chance of collision / reference to successful / faster collisions / more collisions per unit volume / more collisions with energy above activation energy IGNORE particles more compact / particles more dense NOTE more collisions or more successful collisions is not sufficient

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Question	Answer	Marks	Guidance
3(e)	M1 particles move faster / particles have more kinetic energy (1) M2 more successful collisions / more collisions involve equal or more than activation energy / more particles with equal or more than activation energy / more effective collisions / more energetic collisions (1)	2	NOTE marking points are all comparative IGNORE references to equilibrium ALLOW atom, ion or molecule for particle ALLOW more kinetic energy between particles IGNORE more kinetic energy if no reference to particles / particles move more / particles move further apart or closer together IGNORE particles gain energy / particles gain thermal energy / particles have enough energy ALLOW more particles have enough activation energy / more particles have minimum energy needed to react IGNORE more fruitful collisions / successive collisions / more powerful collisions / faster collisions / more significant collisions NOTE more collisions / higher collision frequency / increased rate of collisions / more chance of a collision is not sufficient but ALLOW more effective collision rate / more successful collision rate REJECT activation energy increases or decreases for M2

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Question	Answer			Marks	Guidance
4(a)		observation at anode	observation at cathode	4	NOTE each correct answer = 1 mark IGNORE correct or incorrect names of products ALLOW copper anode dissolves / copper anode decreases (in size) / copper cathode increases (in size) / brown (solid) at cathode / red-brown (solid) at cathode / orange (solid) at cathode IGNORE copper anode melts away / copper cathode coated with copper IGNORE at graphite anode colourless gas ALLOW for cathode brown (solid) / red-brown (solid) / orange (solid)
	copper electrodes	gets smaller / disappears / mass decreases	gets bigger / (coated with) pink (solid) / mass increases		
	graphite electrodes	bubbles / fizzes	(coated with) pink (solid) / gets bigger / mass increases		
	[4]				
4(b)	(anode) $2\text{I}^- \rightarrow \text{I}_2 + 2\text{e}^-$ (1) (cathode) $\text{Ba}^{2+} + 2\text{e}^- \rightarrow \text{Ba}$ (1)			2	ALLOW correct multiples ALLOW $2\text{I}^- - 2\text{e}^- \rightarrow \text{I}_2$ IGNORE state symbols ALLOW one mark if both equations correct but at incorrect electrodes
4(c)(i)	does not react with electrolyte or products			1	ALLOW does not take part in the reaction ALLOW unreactive / does not react IGNORE less reactive / neutral / reference to electronic shells / does not dissolve / does not react easily
4(c)(ii)	platinum			1	ALLOW Pt but name of element takes precedence ALLOW gold / silver

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Question	Answer	Marks	Guidance
4(d)(i)	+2	1	ALLOW +II IGNORE 2+
4(d)(ii)	(oxidation) magnesium (atom) loses electrons / oxidation number of magnesium increases (1) (reduction) copper(II) ions gain electrons / oxidation number of copper decreases (1)	2	NOTE ionic half equation is not sufficient needs reference to what is happening with the electrons IGNORE number of electrons lost or gained ALLOW (reduction) copper ions gain electrons ALLOW oxidation number of copper ions decreases REJECT copper gains electrons / copper is reduced ALLOW oxidation involves losing electrons or oxidation number increases AND reduction involves gaining electrons or oxidation number decreases for one mark if no other mark awarded

Question	Answer	Mark	Guidance
5(a)	bubbles / fizzes / effervesces / colourless solution obtained	1	IGNORE zinc dissolves ALLOW pieces of zinc get smaller / zinc disappears IGNORE reaction mixture gets warmer
5(b)	to use up all the acid	1	IGNORE to get pure zinc chloride

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Question	Answer	Marks	Guidance
5(c)	mol of zinc = 0.04985 OR 3.24 / 65 (1) so mols of HCl needed = 0.04985 × 2 OR 0.0997 (1) actual mol of HCl = 0.050 × 1.50 OR 0.075 (so not enough HCl) (1) OR mol of HCl = 0.050 × 1.50 OR 0.075 (1) so mol of zinc needed = 0.075 ÷ 2 OR 0.0375 (1) actual mol of zinc = 0.04985 (so excess zinc) / so actual mass of zinc is 2.4375 (1)	3	ALLOW at least two decimal places and truncation NOTE an alternative route is: • mol of zinc = 0.04985 • mol of HCl = 0.075 • mol ratio is 1:1.5 / mol ratio of Zn to HCl is smaller than 1:2
5(d)	filtration	1	ALLOW use filter paper IGNORE decanting / centrifuging REJECT distillation / evaporation

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Question	Answer	Marks	Guidance
5(e)	M1 heat solution to get a saturated solution / heat to reduce volume by half / heat to reach crystallisation point / heat to the first appearance of crystals (1) M2 allow (solution) to evaporate slowly / leave (solution) to cool (1) M3 filter off crystals, wash with water and dry with filter paper (1)	3	IGNORE any comments about making aqueous solution from zinc and hydrochloric acid ALLOW heat to remove some water / heat to concentrate the solution ALLOW boil instead of heat / evaporate instead of heat / warm instead of heat REJECT heat or boil to dryness for M1 and M2 ALLOW leave (solution) in a warm place, e.g. by window sill ALLOW leave solution for some time / leave solution for at least a day M2 REJECT leave to dry / use an oven to dry ALLOW for M3 wash or rinse crystal (with water) and dry with filter paper or paper towel ALLOW wash with an organic solvent rather than water IGNORE pick out crystals ALLOW drying in an (warm) oven for M3 if crystals have been washed NOTE for M3 the method of drying must be stated ALLOW for M3 wash crystals and then dry in a desiccator REJECT heat in an oven

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Question	Answer	Marks	Guidance
6(a)	have mobile electrons	1	NOTE delocalised electrons is not sufficient / free electrons is not sufficient IGNORE electrons carry charge REJECT moving ions
6(b)(i)	aluminium has a lower density	1	ALLOW ORA ALLOW reference to transition element instead of copper ALLOW aluminium has a low density / copper has a high density IGNORE aluminium is lighter / aluminium is lightweight ALLOW aluminium is silver or grey in colour / copper is pink, red brown, orange, etc. in colour IGNORE reference to hardness / malleability and ductility NOTE unqualified density or colour is not sufficient REJECT references to corrosion
6(b)(ii)	copper has coloured compounds / copper has more than one oxidation state	1	ALLOW ORA ALLOW reference to transition element instead of copper ALLOW copper has catalytic properties ALLOW copper has more than one valency / aluminium is more reactive / aluminium is higher in the reactivity series / copper does not react with dilute acids to give hydrogen IGNORE reference to group numbers

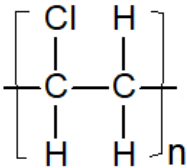
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Question	Answer	Marks	Guidance
6(c)(i)	zinc	1	
6(c)(ii)	M1 brass has particles with different sizes (1) M2 layers (of atoms or ions) in brass cannot slide (as easily as in pure copper) (1)	2	ALLOW atoms or ions for particles ALLOW copper has same sized particles IGNORE atoms have different shapes REJECT brass atoms are different sizes but ALLOW the atoms in brass are different sizes REJECT for M1 reference to brass being a compound ALLOW reference to molecules in M2 but not M1 ALLOW layers in copper can slide (but no layers in brass) NOTE atoms cannot slide as easily is not sufficient
6(d)(i)	has an oxide layer (on surface) (1) outer layer is waterproof / does not let water through / is impermeable (to water and/or oxygen) (1)	2	NOTE references to aluminium rusting or not rusting = 1 mark maximum NOTE M2 is independent of M1 providing the answer is about a layer or coating NOTE it is a physical barrier is not sufficient but ALLOW a barrier to water, oxygen and/or air ALLOW insoluble in water / non-porous IGNORE it does not react with water / oxide layer is unreactive NOTE layer protects from air or water is not sufficient

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Question	Answer	Marks	Guidance
6(d)(ii)	aircraft (1) because it has a low density (1) OR overhead (electrical) cables (1) because it has a low density / has good electrical conductivity (1) OR window frames (1) because it is malleable / does not corrode (1)	2	M2 is dependent on M1 or a near miss for M1 IGNORE lightweight / aluminium has a lower density NOTE reference to electricity or electrical only needed once within the answer NOTE used as wires unqualified is not sufficient for M1 IGNORE it is less dense IGNORE used as foil / soda cans / used in food containers ALLOW to make surgical tools (1) because it does not corrode (1)
6(e)(i)	lowers the operating temperature (of the cell) / increases the electrical conductivity of the electrolyte	1	ALLOW lowers the melting point of the bauxite or aluminium oxide / to lower the energy requirement for the process / less heat needed in process IGNORE used as an electrolyte / dissolve the bauxite / reduce costs unqualified / lowers the melting point unqualified REJECT lowers the melting point of aluminium / it is a catalyst

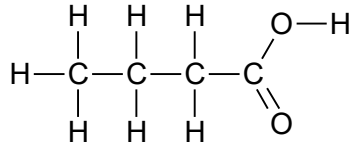
Question	Answer	Marks	Guidance
6(e)(ii)	carbon reacts with oxygen formed to produce carbon dioxide	1	ALLOW anode reacts with oxygen to form carbon dioxide ALLOW mark from a word or symbol equation IGNORE reference to carbon or anode burning or corroding / electrode decomposing REJECT electrode dissolves

Question	Answer	Mark	Guidance
7(a)	 M1 correct repeat unit (1) M2 continuation bonds (and n shown) (1)	2	IGNORE brackets and n they are not needed for M1 or M2 ALLOW for M1 $\text{CHCl}-\text{CH}_2$ / CHClCH_2 NOTE repeat unit does not need continuation bonds and can be part of a larger structure REJECT structures with carbon-carbon double bonds for both M1 and M2 NOTE M2 is dependent on M1 ALLOW two or more complete repeat units with continuation bonds for M2

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Question	Answer	Marks	Guidance
7(b)	any two from: insoluble in water (1) non-biodegradable / does not decompose / does not decay (1) unreactive (with water or air) (1)	2	NOTE insoluble unqualified / waterproof is not sufficient ALLOW decomposes (very) slowly / takes a long time (at least two hundred years) to decompose / does not degrade IGNORE does not decompose easily ALLOW cannot be hydrolysed ALLOW float in water as an extra marking point IGNORE combustion and formation of toxic gases
7(c)(i)	carbon dioxide / water	1	ALLOW CO ₂ / H ₂ O but name take precedence REJECT methane
7(c)(ii)	carbon monoxide	1	ALLOW CO but name take precedence ALLOW hydrogen chloride / HCl
7(d)	M1 energy associated with bonds broken = $740 + 2 \times 340$ OR 1420 M2 energy associated with making bonds = $242 + 1077$ OR 1319 (1) M3 enthalpy change = $1420 - 1319$	3	IGNORE sign IGNORE sign ALLOW ECF from M1 and M2

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Question	Answer	Marks	Guidance
8(a)	$\text{CH}_3\text{CH}_2\text{OH} + \text{O}_2 \rightarrow \text{CH}_3\text{COOH} + \text{H}_2\text{O}$ (1) bacteria / oxygen (1)	2	ALLOW $\text{CH}_3\text{CH}_2\text{OH} + 2[\text{O}] \rightarrow \text{CH}_3\text{COOH} + \text{H}_2\text{O}$ ALLOW formulae to be displayed, structured or molecular formulae in the equation ALLOW from symbol equation even if not correct but must be O_2 ALLOW from word equation even if not correct IGNORE reference to air / acid / heat / warm REJECT anaerobic conditions / lack of oxygen REJECT high temperatures / temperatures above 50°C / use of KMnO_4 / use of $\text{K}_2\text{Cr}_2\text{O}_7$
8(b)		1	REJECT $-\text{OH}$ since no bond between O and H
8(c)	same molecular formula but different structural formulas	1	ALLOW structures / displayed formulas instead of structural formulas
8(d)(i)	<u>butyl propanoate</u>	1	NOTE spelling must be correct REJECT but-1-yl propanoate
8(d)(ii)	$\text{CH}_3\text{CH}_2\text{COOCH}_2\text{CH}_2\text{CH}_2\text{CH}_3$	1	ALLOW displayed or structural formula or a mix but it must be unambiguous ALLOW $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{O}_2\text{CCH}_2\text{CH}_3$

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Question	Answer	Marks	Guidance
8(d)(iii)	heat / reflux / acid catalyst	1	ALLOW H_2SO_4 / H_3PO_4 / (concentrated) sulfuric acid / (concentrated) phosphoric acid ALLOW any quoted temperature between 50 and 165 °C / warm IGNORE high temperature / any pressure quoted / dilute sulfuric acid
8(e)	$\text{C}_8\text{H}_{16}\text{O}_2$ (2)	2	ALLOW one mark for $\text{C}_7\text{H}_{15}\text{COOH}$ / $\text{C}_7\text{H}_{15}\text{CO}_2\text{H}$ NOTE consider general formula for carboxylic acid as working out and ignore