

Cambridge O Level

CHEMISTRY**5070/21**

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 **29** 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 applied
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. SO		
1(a)	ZnO	1	ALLOW zinc oxide / Zn
1(b)	CO ₂ / SO ₂	1	ALLOW carbon dioxide / sulfur dioxide
1(c)	NH ₂ OH	1	ALLOW hydroxylamine
1(d)	ZnO / NO	1	ALLOW zinc oxide / Zn / NO / nitrogen monoxide
1(e)	C ₂ H ₄	1	ALLOW ethene

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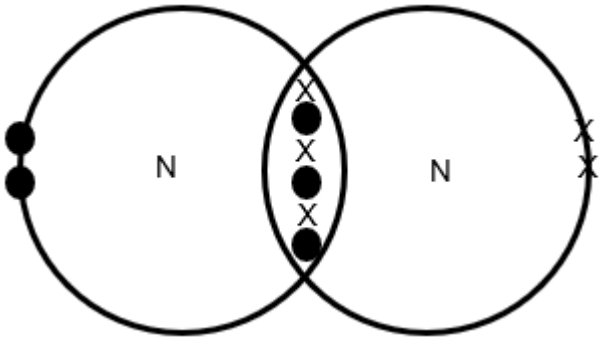
Question	Answer	Marks	Guidance
2(a)	moles of $\text{NaN}_3 = 13.6 / 65$ OR 0.20923 (1) mols of $\text{N}_2 = 1.5 \times 13.6 / 65$ OR 1.5×0.20923 OR 0.313846 (1) vol of $\text{N}_2 = 7.53 \text{ (dm}^3\text{)}$ (1)	3	FIRST LOOK AT FINAL ANSWER • IF any value between 7.44 and 7.56 and three sig figs = 3 MARKS • IF any value between 7.44 and 7.56 but not three sig figs = 2 MARKS • IF 0.313846 = 2 MARKS • IF any value between 3.20 and 3.36 and three sig figs = 2 MARKS • IF any value between 3.20 and 3.36 but not three sig figs = 1 MARKS • IF any value between 4.80 and 5.02 and three sig figs = 2 MARKS • IF 0.20923 = 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

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Question	Answer	Marks	Guidance
2(b)(i)	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(b)(ii)	high melting point / high boiling point (1) conducts electricity in (aqueous) solution (1)	2	IGNORE crystalline solid or solid but ALLOW solid at room temperature as an alternative to high melting or boiling point IGNORE higher melting or boiling point NOTE conducts electricity in aqueous solution scores 2 marks ALLOW conducts electricity as a molten liquid / does not conduct electricity as a solid as an extra marking point ALLOW insoluble in non-polar solvent or a named non-polar solvent or an organic solvent / soluble in water / dissolves in water as an extra marking point ALLOW it is white / colourless as an extra marking point IGNORE references to density / hard REJECT insoluble in water / malleable / ductile
2(b)(iii)	N_3^- (1)	1	ALLOW $\text{Na}^+ \text{N}_3^-$ but REJECT Na N_3^- ALLOW 2N_3^- etc.

Question	Answer	Marks	Guidance
2(c)	(separation) particles are widely apart / large distance between particles / spread far apart / are far apart (1) (arrangement) random arrangement / irregular arrangement (1) (motion) moving (very) fast / have a large amount of kinetic energy / random (motion) (1)	3	IGNORE further apart but ALLOW further apart than in a liquid ALLOW disordered / not ordered / irregular (arrangement) / scattered NOTE no arrangement / not fixed are insufficient ALLOW move in all directions IGNORE move freely / not fixed IGNORE move faster but ALLOW move faster than in a liquid IGNORE vibration and rotation NOTE random can only score one mark either for M2 or M3
2(d)		1	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 pair do not have to be shown as a pair REJECT additional non-bonded electrons

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Question	Answer	Marks	Guidance
2(e)	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)(i)	energy of products less than energy of reactants	1	ALLOW ΔH arrow goes downwards ALLOW energy or enthalpy of reactant more than energy of product IGNORE ΔH is negative IGNORE reference to bond making and bond forming / energy or heat is released NOTE has a negative gradient is not sufficient but ALLOW ΔH has a negative gradient ALLOW level of reactants is higher than level of products / reactants are above products
3(a)(ii)	bond breaking endothermic AND bond making exothermic / energy absorbed to break bonds AND energy released on making bonds (1) more energy released than absorbed (1)	2	ALLOW heat in place of energy REJECT energy used for bond making NOTE this is independent of M1 NOTE more energy released during making bonds than absorbed during bond breaking = 2 marks IGNORE more bonds made than broken REJECT more energy used in bond making than bond breaking IGNORE bond making energy is more than bond breaking energy but ALLOW M1 correct AND bond making energy is more than bond breaking energy = 2 marks

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Question	Answer	Marks	Guidance
3(b)	minimum energy that colliding particles must have in order to react	1	NOTE activation energy is not sufficient ALLOW minimum energy for a reaction to occur ALLOW minimum energy to initiate a reaction

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Question	Answer	Marks	Guidance
3(c)	advantage any one from: water is the only product / no carbon dioxide made (1) higher efficiency (1) quieter (1) transfer more energy per gram of fuel (1) (hydrogen is) a renewable (source of energy) (1) disadvantage any one from: idea of difficult to store the hydrogen (under pressure) (1) limited availability of hydrogen (1)	2	NOTE assume answers refer to the fuel cell but ALLOW ORA if petrol or gasoline specified ALLOW no carbon monoxide made / no carbon emissions IGNORE does not produce toxic gases, harmful gases or oxides of nitrogen IGNORE environmentally friendly / green / non-polluting / no greenhouse gases / global warming / less polluting IGNORE more effective NOTE comparison of thermal energy produced is not sufficient ALLOW saves fossil fuels / hydrogen is not a limited resource / sustainable IGNORE safer / references to cost / oxygen is renewable IGNORE lightweight / compact ALLOW hydrogen is difficult to store ALLOW few filling stations for hydrogen ALLOW fuel cells don't last as long as petrol engines ALLOW less efficient at low temperature IGNORE hydrogen is flammable / explosive IGNORE expensive / expensive to run IGNORE it is difficult to store unqualified by hydrogen

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

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

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Question	Answer			Marks	Guidance
4(a)		concentrated aqueous potassium iodide	dilute aqueous potassium iodide	4	NOTE each correct answer = 1 mark ALLOW ionic equations even if incorrect with correct product NOTE if both formula and name given both must be correct ALLOW O / H / I
	product formed at anode	iodine / I ₂ (1)	oxygen (and water) / O ₂ (and H ₂ O) (1)		
	product formed at cathode	hydrogen / H ₂ (1)	hydrogen / H ₂ (1)		
4(b)	(anode) 2I ⁻ → I ₂ + 2e ⁻ (1) (cathode) K ⁺ + e ⁻ → K (1)			2	ALLOW correct multiples / e for e ⁻ IGNORE state symbols ALLOW 2I ⁻ – 2e ⁻ → I ₂ ALLOW one mark if both equations correct but at incorrect electrodes
4(c)	inert / does not react with electrolyte or products (1) <				

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Question	Answer	Marks	Guidance
4(d)(i)	+2	1	ALLOW +II IGNORE 2+
4(d)(ii)	(oxidation) iodide(ion) loses electrons / oxidation number of iodine increases (1) (reduction) copper(II) ions gain electrons / oxidation number of copper decreases (1)	2	REJECT iodine loses electrons but ALLOW iodine ions lose electrons 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 AND reduction involves gaining electrons OR oxidation involves oxidation number increasing AND reduction involves oxidation number decreasing for one mark if no other mark awarded

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

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Question	Answer	Marks	Guidance
5(c)	mol of aluminium = 0.12 OR 3.24 / 27 (1) so mols of H₂SO₄ needed = 0.12 × 1.5 OR 0.18 (1) actual mol of H₂SO₄ = 0.050 × 2.50 OR 0.125 (so not enough H₂SO₄) (1) OR mol of H₂SO₄ = 0.050 × 2.50 OR 0.125 (1) so mol of aluminium needed 0.0125 ÷ 1.5 OR 0.0833 (1) actual mol of aluminium = 0.12 (so excess aluminium) (1) OR mass aluminium needed is 2.25 g (so is in excess)	3	ALLOW at least two decimal places and truncation NOTE an alternative route is: • mol of aluminium = 0.12 • mol of H₂SO₄ = 0.125 mol ratio is 1:1.04 / mol ratio of H₂SO₄ to Al is smaller than 1:1.5
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

Question	Answer	Marks	Guidance
5(f)	M_r of $\text{Al}_2(\text{SO}_4)_3 = 342$ or formula mass of $16\text{H}_2\text{O} = 288$ (1) M_r of hydrated salt = 630 OR (%) $100 \times \frac{288}{630}$ (1) = 46 / 45.7 (1)	3	FIRST LOOK AT ANSWER - IF 46 / 45.7 / 45.714 / full calculator display = 3 marks - IF 2.9 / 2.86 / 2.8571 / full calculator display = 2 marks - IF 84.2 = 2 marks ALLOW correct number strings ALLOW ECF from incorrect M_r values given or implied in M1 ALLOW at least two sig figs and truncation and IGNORE units ALLOW from incorrect M_r values given or implied in M1 and / or M2
5(g)	white precipitate (1) soluble in excess resulting in colourless solution (1)	2	ALLOW white solid NOTE white precipitate as only answer OR colourless solution as only answer = 1 mark IGNORE goes milky / cloudy precipitate NOTE mention of fizzing = max 1 mark IGNORE any names given for precipitate and the solution. NOTE soluble white precipitate = 1 mark unless the solubility is linked to excess sodium hydroxide ALLOW (precipitate) dissolves in excess / (precipitate) soluble in excess / colourless solution with excess NOTE no ECF from incorrect coloured precipitate

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Question	Answer	Marks	Guidance
6(a)	any two from: act as catalysts (1) more than one oxidation state (in compounds) (1) form coloured compounds (1)	2	ALLOW variable oxidation number / variable valency NOTE form coloured solutions is insufficient NOTE it is coloured is not sufficient ALLOW forms complex ions/complexes as an extra marking point
6(b)	has mobile electrons	1	NOTE delocalised electrons is not sufficient / free electrons is not sufficient IGNORE electrons carry charge REJECT moving ions
6(c)(i)	any two from: carbon (1) nickel (1) chromium (1)	2	

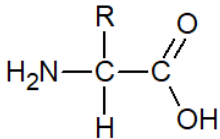
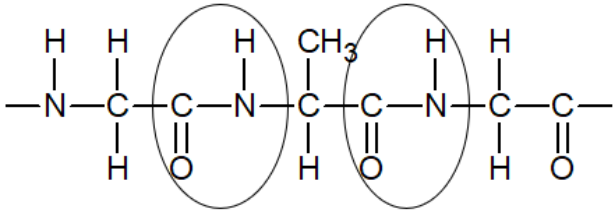
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Question	Answer	Marks	Guidance
6(c)(ii)	stainless steel has particles with different sizes (1) layers (of atoms or ions) in steel cannot slide as easily as in pure iron (1)	2	ALLOW atoms or ions for particles IGNORE atoms have different shapes REJECT steel atoms are different sizes but ALLOW the atoms in steel are different sizes REJECT for M1 reference to steel being a compound ALLOW reference to molecules in M2 but not M1 ALLOW layers in iron can slide (but no layers in steel) NOTE atoms cannot slide as easily is not sufficient

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Question	Answer	Marks	Guidance
6(c)(iii)	coke burns/reacts with oxygen/air to make carbon dioxide / carbon + oxygen $\rightarrow$ carbon dioxide / $C + O_2 \rightarrow CO_2$ (1) coke reacts with carbon dioxide to make carbon monoxide / carbon + carbon dioxide $\rightarrow$ carbon monoxide / $C + CO_2 \rightarrow 2CO$ (1) carbon monoxide reacts with iron(III) oxide to make iron / carbon monoxide + iron(III) oxide $\rightarrow$ carbon dioxide + iron / $Fe_2O_3 + 3CO \rightarrow 3CO_2 + 2Fe$ (1) calcium carbonate forms (carbon dioxide and) calcium oxide / calcium carbonate $\rightarrow$ carbon dioxide + calcium oxide / $CaCO_3 \rightarrow CaO + CO_2$ (1) calcium oxide reacts with sand to make slag / calcium oxide + silicon dioxide $\rightarrow$ calcium silicate / $CaO + SiO_2 \rightarrow CaSiO_3$ (1)	5	ALLOW symbol equation balanced or unbalanced NOTE words and equations should not contradict ALLOW carbon for coke ALLOW carbon dioxide is reduced (by coke) to carbon monoxide IGNORE $C + CO_2 \rightarrow CO$ (doesn't negate words) ALLOW hematite for iron(III) oxide ALLOW limestone for calcium carbonate ALLOW calcium silicate for slag

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Question	Answer	Marks	Guidance
7(a)	forms compound and a small molecule / where two molecules react with loss of a small molecule	1	ALLOW where polymer and water are formed ALLOW reacts to form a polymer and a by-product ALLOW where compounds react to form a product and a small molecule ALLOW 2 monomers react to form a polymer and water / biproduct ALLOW water / small molecule is formed as a by-product ALLOW small molecule / simple molecule as HCl IGNORE water formed / water eliminated / water removed unqualified
7(b)(i)	amino acid	1	
7(b)(ii)		1	ALLOW displayed, structural formula or a mixture of both providing it is unambiguous
7(b)(iii)	any one circle from: 	1	NOTE if two circles drawn both must be around amide group

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Question	Answer	Marks	Guidance
7(c)(i)	diamine (1) dicarboxylic acid (1)	2	NOTE any order IGNORE dicarboxylic / dicarboxyl alone If no marks scored ALLOW 1 max for amine and carboxylic acid
7(c)(ii)	Any one from: land-fills (may fill up) (1) accumulation of plastics/nylon in oceans (1) formation of toxic gases during burning (1)	1	NOTE reference to ozone layer or formation of hydrogen chloride = 0 mark maximum for the question NOTE nylon = plastic throughout ALLOW land dumps for land-fills / need to use land fill NOTE cause land pollution is not sufficient ALLOW plastics in lakes or rivers / killing or harming marine or aquatic organisms by plastic / example of killing marine or aquatic organism / blocks sewage systems NOTE water pollution is not sufficient ALLOW burning plastics produces carbon monoxide / burning plastics produces greenhouse gases / burning produces carbon dioxide IGNORE burning causes global warming ALLOW burning nylon produces hydrogen cyanide / NO _x / ammonia NOTE cause air pollution is not sufficient IGNORE litter / visual pollution ALLOW non-biodegradable / takes a long time to decompose as an extra marking point

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Question	Answer	Marks	Guidance
8(a)	$\text{C}_2\text{H}_4 + \text{H}_2\text{O} \rightarrow \text{CH}_3\text{CH}_2\text{OH}$ (1) and any two from: 300 °C (1) 60 atm / 6000 kPa (1) acid catalyst (1)	3	ALLOW as an equilibrium ALLOW $\text{C}_2\text{H}_4 + \text{H}_2\text{O} \rightarrow \text{C}_2\text{H}_6\text{O} / \text{C}_2\text{H}_5\text{OH}$ ALLOW 250 – 350 °C ALLOW 50 – 70 atm / 5000 – 7000 kPa ALLOW 1 mark for heat or high temperature and high pressure IF values for both temperature and pressure not given ALLOW phosphoric acid / phosphoric(V) acid / H_3PO_4 catalyst
8(b)	<pre> H H H H H — C — C — C — C — H H H O H H </pre>	1	NOTE displayed formula only
8(c)(i)	<u>ethyl propanoate</u>	1	NOTE spelling must be correct
8(c)(ii)	$\text{CH}_3\text{CH}_2\text{COOCH}_2\text{CH}_3$	1	ALLOW displayed or structural formula or a mix but it must be unambiguous ALLOW $\text{CH}_3\text{CH}_2\text{CO}_2\text{CH}_2\text{CH}_3 / \text{C}_2\text{H}_5\text{COOC}_2\text{H}_5$

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Question	Answer	Marks	Guidance
8(c)(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
8(d)	$\text{C}_8\text{H}_{18}\text{O}$ (2)	2	ALLOW one mark for $\text{C}_8\text{H}_{17}\text{OH}$ NOTE consider general formula for alcohol as working out and ignore