CHEMISTRY	**9701/21**
Paper 2 AS Level Structured Questions	**May/June 2025**
MARK SCHEME	
Maximum Mark: 60	

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This document consists of **12** printed pages.

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 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.
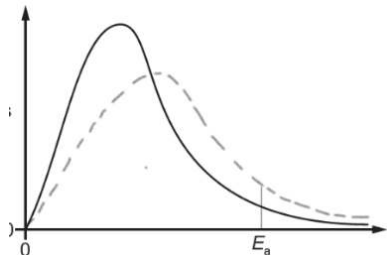
Annotations

Annotation	Meaning
✔	Correct point **or** mark awarded
✖	Incorrect point **or** mark not awarded
?	Unclear
^	Information missing or insufficient for credit
BOD	Benefit of the doubt given
CON	Contradiction in response otherwise markworthy, mark not given
●	Part of the correct answer has been seen. Full credit has not been awarded.
ECF	Error carried forward applied
I	Incorrect or insufficient point ignored while marking the rest of the response
NBOD	Benefit of the doubt not applied in this instance

Annotation	Meaning
RE	Rounding error
REP	Repetition
SEEN	Blank page **or** part of script seen
SF	Error in number of significant figures
TE	Transcription error

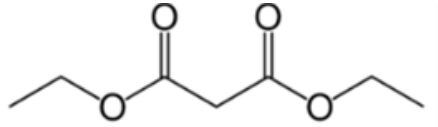| Question	Answer	Marks
1(a)(i)	sodium – metallic **AND** sodium oxide – ionic	1
1(a)(ii)	delocalised electrons move (through the structure)	1
1(a)(iii)	(sodium and oxide) ions move (through the liquid)	1
1(b)(i)	$2Na + 2H_2O \rightarrow 2NaOH + H_2$	1
1(b)(ii)	$Na_2O + H_2O \rightarrow 2NaOH$	1
1(b)(iii)	<table><tr><td></td><td>sodium</td><td>sodium oxide</td></tr><tr><td>one similarity</td><td colspan="2">(both) solids disappear **OR** (both produce) colourless solutions</td></tr><tr><td>one difference</td><td>effervescence</td><td>no effervescence</td></tr></table>	2
1(c)	**M1** $NaCl$ +1 **AND** PCl_5 + 5 **M2** Na has only 1 valence (shell) electrons **AND** P has 5	2
1(d)	*All three for two marks:* • false • comparison or statement of oxidation number • correct link to melting point from their comparison or statement	2

Question	Answer	Marks
2(a)	atoms (of an element) with same number of protons and different number of neutrons	1

Question	Answer	Marks
2(b)(i)	**M1** method showing each abundance multiplied by m/e value • (5.9×54) and (91.9×56) and (2.2×57) **OR** • (0.59×54) and (9.19×56) and (0.22×57) **M2** the three values from **M1** expressed as a percentage and added together correctly with final answer to 1 d.p $$\frac{5.9}{100} \times 54 + \frac{91.9}{100} \times 56 + \frac{2.2}{100} \times 57 = 55.9$$	2
2(b)(ii)	<table><tr><td>particle</td><td>number of particles in one atom of ^{56}Fe</td></tr><tr><td>protons</td><td>26</td></tr><tr><td>nucleons</td><td>56</td></tr></table>	2
2(c)	5	1
2(d)	$Fe(g) \rightarrow Fe^+(g) + e^{(-)}$	1
2(e)	**M1** same electronic configuration **OR** same shielding **M2** same number of protons **OR** same nuclear charge **M3** so same nuclear attraction to outer shell electron **M4** no change / will not be affected	4

Question	Answer	Marks
3(a)(i)	*Two correct for one mark, all four for two marks:* • start at origin • peak sits below the original • peak sits to the right-hand side of the original • new line crosses the original once only **AND** to the right of the original peak	2
3(a)(ii)	**M1** greater proportion of (H_2) molecules have energy greater than or equal to the activation energy $/ \geq E_A$ **M2** increase in frequency of successful collisions (between H_2 and C_6H_{12})	2
3(a)(iii)	catalyst	1
3(a)(iv)	annotation to show new E_A (nickel / catalyst) further to the left than original E_A	1
3(b)	**M1** (if a change is made at a system is dynamic equilibrium) the equilibrium moves **M2** to minimise the change in conditions	2
3(c)	(forward) reaction is exothermic $(a + b) > c$	2

Question	Answer	Marks
4(a)	$C_3H_4O_3$	1
4(b)(i)	$(28.40 / 1000 \times 0.0005) = 1.42 \times 10^{-5}$ mol	1

Question	Answer	Marks
4(b)(ii)	$(1.42 \times 10^{-5} \times 176 \times 200 / 5) = 0.099968$ **M1** correct method to deduce mass of vit C in 5 cm^3 sample $(1.42 \times 10^{-5} \times 176) = 2.49 \times 10^{-3}$ **M2** correct calculation for mass of vit C in original solution $(2.49 \times 10^{-3} \times 200 / 5) = 0.099968$ **OR** **M1** correct method to deduce amount, mol, vit C in 5 cm^3 sample $(1.42 \times 10^{-5} \times 200 / 5) = 5.68 \times 10^{-4}$ **M2** correct calculation for mass of vit C in original solution $= M1 \times 176$ $(5.68\ 10^{-4}) \times 176 = 0.099968$	2
4(b)(iii)	oxidising agent	1
4(b)(iv)	**M1** (also) oxidises / reacts with (primary and / or secondary) alcohol groups **M2** (also) breaks the sigma and pi bond in C=C	2
4(c)	*Any two complete rows from:* 	**wavenumber**	**bond**	**functional group**
1040 – 1300	C–O	ester / hydroxy
3200 – 3650	O–H	hydroxy / alcohols
2850 – 2950	C–H	alkane
1710 – 1750	C=O	ester		2

Question	Answer	Marks
5(a)	**M1** two ester links **M2** rest of structure correct 	2
5(b)	(acid) hydrolysis	1
5(c)(i)	$HOOCCH_2COOH + Na_2CO_3 \rightarrow NaOOCCH_2COONa + CO_2 + H_2O$	1
5(c)(ii)	**C** is not as strong an acid as **B**	1
5(d)(i)	**M1** NaOH(aq) **AND** heat **M2** acidified **AND** potassium dichromate(VI) **AND** heat under reflux	2
5(d)(ii)	oxidation	1
5(e)(i)	LiAlH$_4$	1
5(e)(ii)	**M1** correct unambiguous organic product **M2** correct balanced equation $HOOCCH_2COOH + 8[H] \rightarrow HOCH_2CH_2CH_2OH + 2H_2O$	2
5(e)(iii)	1,3-dichloropropane	1

Question	Answer	Marks
6(a)	carbonyl	1
6(b)	**M1** (2,4)-dinitrophenylhydrazine / (2,4)-DNPH **M2** orange / red / yellow precipitate	2

Question	Answer	Marks
6(c)(i)	**F** = propanone **G** = ethanal **H** = propanal	**2**
6(c)(ii)	tri-iodomethane **OR** CHI_3	**1**
6(c)(iii)	$CH_3CH(OH)$-R where R is represented as H or any alkyl group	**1**