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CAMBRIDGE
International Education

Cambridge International AS & A Level

CHEMISTRY **9701/33**

Paper 3 Advanced Practical Skills 1 **October/November 2025**

MARK SCHEME

Maximum Mark: 40

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

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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.

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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.

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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.

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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
BOD	Benefit of the doubt given
CON	Contradiction in response otherwise markworthy, mark not given
DP	Error in number of decimal places
ECF	Error carried forward applied
I	Incorrect or insufficient point ignored while marking the rest of the response
RE	Rounding error
REP	Repeat error
SEEN or /	Blank page **or** part of script seen

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Annotation	Meaning
SF	Error in number of significant figures
TE	Transcription error

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Mark Scheme abbreviations

;	separates marking points
/	alternative responses for the same marking point
R	reject the response
A	accept the response
I	ignore the response
ecf	error carried forward
AVP	any valid point
ora	or reverse argument
AW	alternative wording
underline	actual word given must be used by candidate (grammatical variants excepted)
( )	the word / phrase in brackets is not required but sets the context
max	indicates the maximum number of marks that can be given
M1 etc.	marking point
owtte	or words to that effect

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Question	Answer	Marks
1(a)	**I** Five experiments completed **AND** Table to show Volume of **FA 1**, Volume of water, Time and Rate	**1**
	II Correct units for all data Volume: / cm^3 **OR** (cm^3) **OR** in cm^3 **OR** cm^3 by each volume Time: / s **OR** (s) **OR** in s **OR** s by each time Rate: / s^{-1} **OR** (s^{-1}) **OR** in s^{-1} **OR** s^{-1} by each rate	**1**
	III All times recorded to nearest second **AND** Volumes of **FA 1** and water both given 2 d.p. ending with 0 or 5	**1**
	IV Three additional experiments with volume **FA 1** $\geqslant$ 15.00 cm^3, < 40.00 cm^3 and no volume closer than 5.00 cm^3 to another volume. **AND** Volumes of water chosen so that total volume = 40.00 cm^3 for additional experiments.	**1**
	V Correctly calculates rate for all experiments and shown to 2 – 4 s.f.	**1**
	VI Award if all times recorded increase with decreasing volume of **FA 1**.	**1**
	Examiner corrects time for V_{FA1} = 40.00 cm^3 and V_{FA1} = 20.00 cm^3 to the nearest s then calculates t_{20} / t_{40} to 2 d.p.	
	VII Award if candidate's ratio is within the range 1.80 to 2.30.	**1**
	VIII Award if candidate's ratio is within the range 1.90 to 2.20.	**1**

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Question	Answer	Marks
1(b)(i)	**I** Unambiguous labelled axes with rate on the y-axis and volume of **FA 1** on the x-axis **OR** correct units **AND** suitable linear scales starting at (0,0).	**1**
	II Points plotted correctly.	**1**
	III Line of best fit drawn, straight line or smooth curve, that ignores anomalous results identified by the candidate.	**1**
1(b)(ii)	**M1** Correct line(s) drawn **AND** Rate correctly read within half a small square. **M2** $^{1000}/_{\text{rate}}$ **AND** correctly calculates answer to 2 – 4 s.f.	**2**
1(c)	**M1** Correct line of best fit **M2** (Rate and volume of **FA 1** are) not directly proportional as the (straight) line / data / results does not / do not pass through the origin / (0,0) **OR** **M1** unavailable for line of best fit through the origin. **M2** (Rate and volume of **FA 1** are) directly proportional as the (straight) line / data / results pass through the origin / (0,0)	**2**

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Question	Answer	Marks
2(a)	**I** 6 correct unambiguous headings shown, with units, in list / table • (mass of) container + **FA 3** / solid / $Na_2S_2O_3•5H_2O$ • (mass of) container (empty **OR** with residual **FA 3**) • (mass of) **FA 3** / solid / $Na_2S_2O_3•5H_2O$ **OR** mass used **OR** mass added • initial temperature / thermometer reading • lowest / minimum / final temperature / thermometer reading • temperature change / decrease Mass units: /g **OR** in g **OR** (g) **OR** g by every reading Temperature units: / °C **OR** in °C **OR** (°C) **OR** °C by every reading	**1**
	II All readings shown to appropriate precision • all four balance / thermometer readings shown • both thermometer readings to .0 **OR** .5 • both weighings consistently to either 2 d.p. **OR** to 3 d.p.	**1**
	III Subtractions correctly calculated • mass of solid correct **AND** temperature change correct	**1**
	IV ΔT is within 1.0 ºC of expected temperature change for the mass used	**1**
2(b)(i)	Correctly calculates amount of **FA 3** = $\frac{\text{mass FA 3 in 2(a)}}{248.2}$ mol **AND** answer given to 2–4 s.f.	**1**
2(b)(ii)	Correctly calculates energy change = $30 \times 4.18 \times \Delta T$ J **AND** answer given to 2 – 4 sf	**1**

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Question	Answer	Marks
2(b)(iii)	Correctly uses $\frac{\textbf{(b)(ii)}}{\textbf{(b)(i)}} \times 1000$ **AND** plus sign shown **AND** answer given to 2 – 4 sf	**1**
2(c)	**M1** repeating experiment with $Na_2S_2O_3$ **OR** adding $Na_2S_2O_3$ in water **M2** any two from: • known volume of water • known mass of solid • measuring the temperature change. **M3** indicating that use of Hess's law is needed **M4** $\Delta H_r = \Delta H$ from their additional experiment – **(b)(iii)**	**4**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td colspan="3">FA 4 is acidified $Fe_2(SO_4)_3$(aq); FA 5 is $Al_2(SO_4)_3$(aq); FA 6 is HCOOH(aq); FA 7 is $CH_3CH(OH)CH_3$(l)</td></tr>
<tr><td>3(a)(i)</td><td>2 * = 1 mark (round down). Max 5 marks.
<table>
<tr><th rowspan="2">test</th><th colspan="2">observations</th></tr>
<tr><th>FA 4</th><th>FA 5</th></tr>
<tr><td>1
+ NaOH(aq)</td><td>red-brown / brown ppt
AND
insoluble in excess *</td><td>white ppt *
soluble in excess *</td></tr>
<tr><td>2
+ NH_3(aq)</td><td>red-brown / brown ppt
AND
insoluble in excess *</td><td>white ppt
AND
insoluble in excess *</td></tr>
<tr><td>3
+ Na_2CO_3(aq)</td><td>fizzing *
gas gives white ppt with limewater *
red-brown ppt *</td><td>white ppt *
fizzing *
gas gives white ppt with limewater (award if not awarded for FA 4)</td></tr>
<tr><td>4
+ $BaCl_2$(aq) / $Ba(NO_3)_2$(aq)</td><td>white ppt AND</td><td>white ppt *</td></tr>
<tr><td>5
+ H^+ / $KMnO_4$(aq)</td><td>stays purple / no change AND</td><td>stays purple / no change *</td></tr>
</table></td><td>5</td></tr>
</table>

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>3(a)(ii)</td><td>
<table>
<tr><th>ions</th><th>FA 4</th><th>FA 5</th></tr>
<tr><td>cations</td><td>Fe^{3+}; H^{+}</td><td>Al^{3+}</td></tr>
<tr><td>anions</td><td>SO_4^{2-}</td><td>SO_4^{2-}</td></tr>
</table>
5 ions correct = 3 marks
3 or 4 ions correct = 2 marks
2 ions correct = 1 mark
</td><td>3</td></tr>
<tr><td>3(b)(i)</td><td>2 * = 1 mark (round down)
<table>
<tr><th rowspan="2">test</th><th colspan="2">observations</th></tr>
<tr><th>FA 6</th><th>FA 7</th></tr>
<tr><td>1
+ H^{+} / $KMnO_4$(aq)</td><td>(turns paler pink)</td><td>(purple fades slightly)</td></tr>
<tr><td>and warm</td><td>decolourises / turns colourless / turns (pale) yellow *</td><td>decolourises / turns colourless / turns (pale) yellow *</td></tr>
<tr><td>2
+ I_2(aq) + NaOH (and warm)</td><td>no change *</td><td>ppt * that is (pale) yellow *</td></tr>
<tr><td>3
+ Na_2CO_3(aq)</td><td>fizzing *</td><td>no change *</td></tr>
</table>
</td><td>3</td></tr>
</table>

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Question	Answer	Marks
3(b)(ii)	**M1** (**FA 6** is) methanoic acid because it produces CO_2 / reacts with sodium carbonate **AND** it can be oxidised / it reacts with $KMnO_4$ **M2** (**FA 7** is) propan-2-ol as it gives a ppt in test 2 **OR** gives a positive tri-iodomethane/iodoform test **OR** has the $-CH(OH)CH_3$ group	**2**
3(c)	Correct equation $CH_3CH_2COOH + CH_3CH_2OH \rightarrow CH_3CH_2COOCH_2CH_3 + H_2O$ **OR** $C_2H_5COOH + C_2H_5OH \rightarrow C_2H_5COOC_2H_5 + H_2O$	**1**

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