CAMBRIDGE
International Education

Cambridge International AS & A Level

CHEMISTRY **9701/37**

Paper 3 Advanced Practical Skills 1 **May/June 2026**

MARK SCHEME

Maximum Mark: 40

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 **26** printed pages.

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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.

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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	<u>Calculation specific guidance</u> 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	<u>Guidance for chemical equations</u> 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 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
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

Mark Scheme abbreviations

/	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
M	marking point
Ppt	precipitate
sf	significant figures

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Accuracy marks must be recorded on the spreadsheet provided, on an accuracy grid or on a blank part of the Supervisor's script. If using a spreadsheet or accuracy grid, this must be printed and stapled inside the Supervisor script. The relevant Supervisor results must be written and ringed on **each candidate script**.

When awarding the accuracy (Q) mark in **Question 1**, record:

- candidate's number
- candidate's volume
- mark awarded

When awarding accuracy marks in **Question 2** record:

- candidate titre
- difference from supervisor, δ
- mark awarded
- any adjustment (spread adjustment (SA), 50-adjustment (50-A) or rough titration adjustment (RTA))

In either question, where more than half the candidates score no marks against the supervisor value, **please contact your team leader (TL)**.

Practical issues at a centre sometimes mean that candidates cannot access all of the marks. In such cases, contact your TL. Candidate marks may need to be scaled.

Reject <u>either</u> a rounding error (RE) <u>or</u> a transcription error (TE) only once in the paper. Note: Reject REs <u>only</u> in 'correctly calculates'. Reject fractions in place of decimal answers only once in the paper.

Restarts: In calculations sections of quantitative analysis questions, candidates may gain credit in a question part by using either a previous incorrect answer **or** they may 'restart' the calculation using their experimental data correctly. Annotate either 'ecf' or 'allow: restart'.

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Question	Answer	Marks	Guidance
1(a)	**M1**: unambiguous headings and correct units in the space for results to show: • (mass of) container + **FA 1** / Mg / contents • (mass of) container (+ residue) • (mass of) **FA 1** / Mg • (volume of) gas / H_2 produced or volume **and** correct subtraction for mass of **FA 1** / Mg	**1**	**R** weight / m for mass. **R** starting / initial mass; ending / final mass only; change in mass. **A** vol / V / final volume / total volume of gas / change in volume of gas. **A** (g), / g, / grams, / grammes, / cm^3, (cm^3). **R** gram, gr, / (g), (/ g), ml / cc. Use of stopper / cap must be consistent. **I** Headings and relative values for additional volume readings. However, if initial and final volume are given, **R** incorrect subtraction or unit incorrectly displayed. **I** any further additional data unless contradictory or unless unit is incorrectly displayed. If initial and final volume are given, subtraction must be correct. If multiple data sets provided, use first set. **A** units with headings **or** next to each data item. **A** units with heading **and** next to data as long as they are both correct. **R** if mass of container and residue > mass of container and **FA 1**.
	M2: both balance readings recorded consistently to either 2 or 3 dp **and** volume recorded to integer value	**1**	**A M2** and **M3** from figures alongside method but do not look ahead to calculations. **A** balance readings to 4 dp. **R** 1 dp readings unless supervisor's report indicates the centre does not have 2 dp balances. **A** trailing zeros to be missing from calculated mass of **FA 1** / Mg **R** xxx.0 or xxx.00 for integer volumes

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Question	Answer	Marks	Guidance
1(a)	**Accuracy mark** Correct supervisor's gas volume to an integer. Write and ring this value next to the volume given by the candidate. Calculate supervisor's volume ± 20%, and round to the nearest integer, to give range within which the candidate gains M3. If using an accuracy grid or the supervisor's script to record accuracy marks record the range.		
	M3: volume of H_2 is within 20% of the supervisor's value	**1**	**R** if volume of H_2 is > 250 cm^3, even if within 20% of supervisor value. If supervisor volume is > 250 cm^3, treat as if no supervisor results were present. If initial and final gas volumes are recorded, and volume of gas is incorrectly calculated, calculate the correct volume of gas before awarding **M3.**
1(b)(i)	**Correctly calculates** amount of Mg $= \frac{\text{mass in } \textbf{(a)}}{24.3\,\text{mol}}$ **and** answer given to 2–4 significant figures (sf)	**1**	**R** incorrect sf only once in **1(b)**. **R** use of 24 for the A_r of Mg. **A** answer correct to minimum 3 sf if no working shown.
1(b)(ii)	$Mg(s) + 2H^+(aq) \rightarrow Mg^{2+}(aq) + H_2(g)$	**1**	
1(b)(iii)	**Correctly uses** volume of H_2 = **(b)(i)** × 24 000 cm^3 **and** answer given to 2–4 sf	**1**	**R** use of 22 400 cm^3 **I** any use of volume from **1(a)** **A** answer correct to minimum 3 sf if no working shown
1(c)	Any **two** of: • Some gas / hydrogen escaped **before the bung was fitted** • The temperature was lower / the (atmospheric) pressure was higher than normal 'room conditions' • The Mg is impure / corroded	**2**	**I** hydrogen dissolves in water **I** some of the Mg did not react **I** apparatus is not airtight / any leaks after the bung was put in place

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Question	Answer	Marks	Guidance
1(d)	**Shows use** of: 2 dp balance: uncertainty = 0.005* **and** $\text{maximum percentage error} = \frac{(2 \times \text{uncertainty}) \times 100}{\text{mass of } \textbf{FA1}\%}$ **or** 3 dp balance: uncertainty = 0.0005* **and** $\text{maximum percentage error} = \frac{(2 \times \text{uncertainty}) \times 100}{\text{mass of } \textbf{FA1}\%}$	**1**	Put • next to correct uncertainty. **R** uncertainty of 0.01 g for 2 d.p. and 0.001 g uncertainty for 3 d.p. **A** 0.05 for 1 dp balance or 0.00005 for 4 dp balance to match the data in **1(a)**. **I** sf Answer must match the candidate's data for balance readings in **1(a)**. If the candidate was inconsistent in the precision of mass measurements in **1(a)**, balance uncertainty must match the less precise reading.

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Question	Answer	Marks	Guidance
2(a)	**I** The following data are recorded : • two burette readings **and** titre for the rough titration • initial and final burette readings for **two** (or more) accurate titrations	**1**	Headings and units are **not** required for this mark Rough titration readings may be labelled in the accurate table. **I** errors in values for rough titration, e.g. an initial reading of 50, incorrect subtractions.
	II Titre values recorded for accurate titrations **and correct headings** and **units** in a single **accurate** titration table • initial / start **and** (burette) reading / volume • final / end **and** (burette) reading / volume • titre **or** volume **used / added or FA 3 used / added** • unit: / cm^3 **or** (cm^3) **or** in cm^3 (for each heading) **or** cm^3 unit given for each volume recorded.	**1**	**R** if initial and final burette readings do not match the data **A** 'vol' or 'V' or 'value' for 'reading / volume' **R** 'difference' or 'amount' or 'change' or 'titrate' (instead of titre) **I** 'total' (titre) **R** ml / cc, unless already rejected in **1(a)** **R** incorrect display of units unless already rejected in **1(a)**.
	III All accurate burette readings recorded to 0.05 cm^3	**1**	**R** if: • 50(.00) is used as an initial burette reading • More than one final burette reading is 50(.00) • Any burette reading is greater than 50(.00). The requirement to record to 0.05 applies to burette readings, including 0.00 cm^3 (if this was the initial reading), but it does not apply to the **titre.**
	IV The **final** accurate titre recorded must be within 0.10 cm^3 of any other accurate titre	**1**	**I** any reading labelled rough. **R** if these two titres are derived from **any** burette readings recorded as integers (apart from initial 0 cm^3)

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Question	Answer	Marks	Guidance
2(a)	**Accuracy (Q) marks** Round burette readings to the nearest 0.05 cm^3. Check and correct titre subtractions where necessary. Examiner selects the best mean titre, using the following hierarchy: • two (or more) accurate identical titres (ignoring any that are labelled 'rough'), *then* • two (or more) accurate titres within 0.05 cm^3, *then* • two (or more) accurate titres within 0.10 cm^3, *etc* Calculate the difference (δ) between the candidate's mean titre and the supervisor's mean titre. Write and ring supervisor's value next to the accurate titration table for each candidate. Also write the candidate's mean value (calculated by examiner) and difference between supervisor's and candidate's value, δ.		
	Award accuracy Q marks as follows: **V** Award if $\delta \leqslant 0.50\ cm^3$	**1**	A **spread adjustment (SA)** is required if titres selected (by examiner) differ $\geqslant 1.00\ cm^3$ A **50-adjustment (50–A)** is required if 50.(00) is used as initial volume. Use mean of final volume **or** actual titre (whichever gives the better Q score). A **rough titration adjustment (RTA)** is required if **only** a rough titration was carried out. Use the rough titre to award Q marks. If an **adjustment** is required: **V** Award if $\delta \leqslant 0.30\ cm^3$ **VI** Award if $\delta \leqslant 0.20\ cm^3$ **VII** Not available
	VI Award if $\delta \leqslant 0.30\ cm^3$	**1**	If only **one** accurate titration was carried out, use it to award Q marks as normal. **A** (bod) for accuracy marks from titre values with no readings shown. For Supervisor's mean titre $\geqslant 50.00\ cm^3$: 3 marks: 0.30, 2 marks: 0.50, 1 mark: 0.80 cm^3

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Question	Answer	Marks	Guidance
2(a)	**VII** Award if $\delta \leqslant 0.20\ cm^3$	1	For Supervisor's mean titre $\leqslant 10.00\ cm^3$: 3 marks: 0.10, 2 marks: 0.15, 1 mark: 0.25 cm^3 For Supervisor's mean titre $\leqslant 5.00\ cm^3$: 3 marks not available, 2 marks: 0.05, 1 mark: 0.10) Adjustments apply as above.
2(b)	**Correctly calculates mean titre** • Candidate must take the average of two (or more) titres that are within a total spread of not more than 0.20 cm^3. • Working/explanation must be shown **or** ticks must be put next to the two (or more) accurate readings selected. • The mean should be quoted to 2 dp and be rounded to nearest 0.01 cm^3. (e.g. 26.675 cm^3 must be rounded to 26.68 cm^3)	1	Do **not** award this mark if: • The rough titre was used to calculate the mean. • The candidate did only one accurate titration. • Burette readings were incorrectly subtracted to obtain **any** of the accurate titre values. • All burette readings used to calculate the mean were recorded as integers. **A** mean expressed to 1 dp, if **all** accurate burette readings were given to 1 dp or a mix of 1 dp and integers and the mean is **exactly** correct. e.g. if titres are 26.0 and 26.2: mean = 26.1 is correct e.g. if titres are 26.0 and 26.1: mean = 26.1 is wrong (should be 26.05 cm^3) **A** ecf if no readings but only titre values given
2(c)(i)	Answers to **(c)(ii), (c)(iii)** and **(c)(iv)** quoted to 3 or 4 significant figures.	1	Answers must be given for all three question parts. If no value on the answer line, accept final calculated value in the working. Some relevant working is required for at least one question part.
2(c)(ii)	**Correctly calculates** amount of NaOH $= 0.095 \times \frac{\textbf{(b)}}{1000\ mol}$	1	**I** sf in **2(c)(ii)**, **(iii)** and **(iv)**, but **R** 1sf if no working shown. Apply once only in **2(c)**.
2(c)(iii)	**Correctly uses** concentration of acid = **(c)(ii)** $\times$ 40	1	

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Question	Answer	Marks	Guidance
2(c)(iv)	**Correctly uses** M_r of R' = $\frac{15.28}{\textbf{(c)(iii)}}$	1	**A** restart for 15.28 / **(c)(ii)** × 40 (if forgotten to use 40 in **(c)(iii)**)
2(d)(i)	**M1**: reagents: (aqueous) silver nitrate / $AgNO_3$ and (aqueous) ammonia / NH_3	1	**R** Ag^+ for $AgNO_3$, but ecf to M2. **R** 'soluble ppt' for M2. **A** ammonia in the 'observations' space instead of on the reagents line. If formula is given for a reagent, it must be correct, e.g. $AgNO_3$.
	M2: observations: off-white / cream ppt (with silver nitrate) **and** ppt partially soluble / insoluble in ammonia **and** conclusion: Br or Br^- or bromide or bromine	1	If no ammonia used: **A** 1 mark for Silver nitrate / $AgNO_3$ **and** off-white / cream ppt **and** Br or Br^- or bromide or bromine. **or** **A** 1 mark for Silver nitrate / $AgNO_3$ **and** white ppt **and** C*l* or C*l*$^-$ or chloride or chlorine. But **R** if Ag^+ used (two errors). **A** 1 mark for (acidified aqueous) potassium manganate(VII) / $KMnO_4$ **and** turns yellow **and** Br or Br^- or bromide or bromine / I or I^- or iodine or iodide. **R** C*l*$_2$, Br_2, etc.

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Question	Answer	Marks	Guidance
2(d)(ii)	To react with / remove (excess) sodium hydroxide / to prevent hydroxide reacting with Ag^+ **and** so that a (silver hydroxide / false positive) precipitate is not formed	**1**	**I** reference to carbonate ions.

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Question	Answer	Marks	Guidance
2(e)	**M1**: **Correctly uses** Formula mass of R' = **(c)(iv)** – 58 – A_r of halogen identified in **(d)(i)**	**1**	For chlorine mass of R' = **(c)(iv)** – 93.5 For bromine mass of R' = **(c)(iv)** – 137.9 For iodine mass of R' = **(c)(iv)** – 184.9 **A** correct use of their data leading to a negative value. **R** negative answer calculated correctly from data but written as positive. **A** ecf from an incorrect conclusion in **2(d)(i)**, e.g. for –OH. If no working shown, **A** correct answer, (calculated using **(d)(i)** and **(c)(iv)**) to ⩾ 2 sf. Otherwise **I** sf. **A** correct answer written in the space for workings, even if the calculated M_r for their chosen alkyl group is written on the answer line. E.g. 16.1 shown in workings. Answer lines shown 15 and CH_3.
	M2: Identifies R' as the closest C_nH_{2n+1} group to formula mass in **M1**. (CH_3 ⩽ 22 ⩽ C_2H_5 ⩽ 36 C_3H_7 ⩽ 50 C_4H_9 ⩽ 64 ⩽ C_5H_{11} ⩽ 78, etc.)	**1**	**A** name, e.g. methyl (group). **A** R' = H for formula mass of R' < 8. **A** ecf from **M1**, including for negative answer calculated correctly from data but written as positive. **R M2** if calculated answer to **M1** did not use **2(c)(iv)** How to apply this: If correct answer is 16.1: No working and 15.0 on answer line, then CH_3 gets no marks. But correct use of data with no working and 16.1 on answer line, then CH_3 gets two marks. If the candidate gets a negative value for **M1**, **A** CH_3 or H or (BOD) 'my answer is impossible' or words to that effect.

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Question	Answer	Marks	Guidance
2(f)	(The titres are similar therefore) the (calculated) relative formula mass / M_r will be similar **and** Different R' groups would require a large difference (in M_r / titre)	**1**	**I** formula mass is the same. **I** reference to experimental error or apparatus error. **A** Similar M_r AND relative formula masses of R' were within the boundaries for the same identity of R'. For candidates with a mean titre $\leqslant$ 5.00 cm^3, and a sensible comment on the magnitude of 0.35 cm^3 compared to their titre value, contact your TL.

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Question	Answer	Marks	Guidance
3(a)	**M1**: (aqueous) potassium manganate(VII) / $KMnO_4$	1	For **M1**, mark reagents written on the test line only. **A** potassium permanganate. **R** incorrect capitalisation, e.g. $KmNO_4$. **R** manganate(VII) / MnO_4^- alone. **I** potassium manganate with missing or incorrect oxidation number. **I** acid or alkaline conditions for the $KMnO_4$. **I** any reference to Br_2, but **R** other additional tests / reagents.
	M2: stays purple / pink **and** R is saturated	1	**A** no change / does not decolourise ($KMnO_4$). **R** turns purple / pink. **A** R group is not unsaturated. **M2** dependent on **M1**, but allow ecf from a capitalisation or oxidation state error, incomplete reagent, or from $KMnO_4$ not on the test line.

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Question	Answer	Marks	Guidance
3(b)(i)	Award one • for each correct answer (maximum available = 15). Maximum 7 marks.		**Check the supervisor's report**. If the supervisor's report identifies **FA 7** as $CrCl_3$ + $NaNO_3$ or $FeSO_4$ + $NaNO_3$, then follow the separate mark schemes provided. Otherwise use the mark scheme for **FA 7** as $Cr_2(SO_4)_3$(aq) + $NaNO_3$(aq). If a centre appears to be using $CrCl_3$ or $FeSO_4$, and there is nothing to indicate this on the supervisor's report, consult TL. Write ticks on script. The following information applies to all version of the mark scheme for **3(b)(i)**: **Additional tests**: use of additional reagent loses associated • **A** 'no (visible) reaction' for no change, or no ppt for any test except **FA 7** on heating with NaOH and **FA 7** Test 4 with HNO_3. **I** solid, residue, particles for ppt first time seen, then **A** **R** 'no observation' first time seen, then **A** **R** '—' every time seen **R** 'soluble' ppt first 2× seen, then **I** 'soluble' **I** 'ppt becomes soluble' (no mention of 'in excess') first time seen then **A** **I** 'ppt disappears' for dissolves first time seen then **A** **I** temperature changes throughout. **I** cloudy / milky solutions (if ppt also present)

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>3(b)(i)</td><td>Mark Scheme when FA 7 is $Cr_2(SO_4)_3$ and $NaNO_3$ and FA 8 is NaOH</td><td></td><td>If basic chromium sulfate is used, contact your TL</td></tr>
<tr><td></td><td>
<table>
<tr><th></th><th>FA 7</th><th>FA 8</th></tr>
<tr><td>Test 1
+ NaOH

+ heat

+ Al</td><td>grey-green ppt * soluble in excess / forms (dark) green solution *

No change / (red) litmus stays red *

Gas / fizzing / NH_3 turns (damp red) litmus blue *</td><td>no change / no (visible) reaction AND</td></tr>
<tr><td>Test 2
+ $CuSO_4$</td><td>Grey-green ppt AND Insoluble in excess *</td><td>No change / no (visible) reaction *</td></tr>
<tr><td>Test 3
+ $CuSO_4$</td><td>No change *</td><td>(pale) blue ppt*</td></tr>
<tr><td>Test 4
+ Ba^{2+} (aq)

+ HNO_3</td><td>White ppt *

No change / ppt insoluble*</td><td>No change OR (faint) white ppt AND

No change OR (faint white) ppt dissolves / forms colourless solution*</td></tr>
</table>
</td><td>7</td><td>2 * = 1 mark (round down) (15 * available)

R green ppt, grey ppt or any other shade of green ppt for grey-green ppt first time, then A.

FA 7 Test 1 and 6 with NaOH: If no ppt observed, the second blob is available only if it is clear the solution formed is darker green than the original (apply this once only).

FA 7 Test 1: I condensation on heating.

FA 7 Test 1: There must be some reference to gas before testing with litmus paper to award the •

Any incorrect gas test anywhere in FA 7 Test 1 CONs the ammonia test blob (including a positive NH_3 test before the addition of Al). But I a positive test for H_2 after addition of Al.

I any ppt forming in FA 7 test 1 with Al.

FA 8 Test 3: ‘soluble in excess’ CONs the ‘blue ppt’ •
FA 8 Test 4 with Ba^{2+} : A ‘white ppt soluble in excess’ in box 1 and ‘no change’ in box 2.

FA 7 Test 4 with HNO_3: If ‘white ppt’ observed with Ba^{2+}, A white ppt, so long as there is no indication of change.

FA 8 Test 4 with HNO_3: A soluble. I fizzing. If a white ppt was observed in test 4 part 1, R no change with HNO_3

FA 8 Test 5: A white / off-white / cream / any shade of brown ppt. R other colours with brown, e.g. yellow-brown</td></tr>
</table>

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>3(b)(i)</td><td>
<table>
<tr><th></th><th>FA 7</th><th>FA 8</th></tr>
<tr><td>Test 5
+ $AgNO_3$ (aq)</td><td>No change *</td><td>white-brown ppt (insoluble in excess)*</td></tr>
<tr><td>Test 6
+ FA 8</td><td>grey-green ppt* soluble in excess / forms (dark) green solution *</td><td></td></tr>
</table>
2 * = 1 mark
</td><td></td><td></td></tr>
<tr><td>3(b)(ii)</td><td>Cations in FA 7 and FA 8
FA 7 Cr^{3+} / chromium(III)

and

FA 8 unknown</td><td>1</td><td>A Cr^{+3}.
R if Table 3.1 is completely blank.</td></tr>
<tr><td>3(b)(iii)</td><td>M1: NO_2^- / nitrite and / or NO_3^- / nitrate

and

NH_3 liberated on heating with (NaOH /) Al or (OH^- /) Al</td><td>1</td><td>CHECK TABLE 3.1 WHILE MARKING 3(b)(iii)
If more than two anions are identified, mark the first two. (NO_2^- and NO_3^- do not count as separate anions for this purpose).
If formula is given for a reagent, it must be correct, e.g. R $BaNO_3$
A any clear reference to the reaction using (hot NaOH(aq) and) Al e.g. ‘due to the results from (NaOH and) Al’ or reference to test 1 and text from their answer to 3(b)(i) that directly links to Test 1 box 3.
R M1 if no attempt to describe a positive test for NH_3 in Table 3.1 Test 1 box 3
R additional tests to distinguish NO_2^- from NO_3^- unless already rejected in 3(b)(i)</td></tr>
</table>

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Question	Answer	Marks	Guidance
3(b)(iii)	**M2**: SO_4^{2-} / sulfate AND ppt with barium nitrate / Ba^{2+} that is insoluble in (nitric) acid	**1**	**R M2** if **Table 3.1** Test 4 does **not** show a ppt that is insoluble in acid. If neither mark awarded, **A** 1 mark for NO_2^- / NO_3^- AND SO_4^{2-} (with incorrect / missing explanations). Additional ions CON this mark.
3(b)(iv)	OH^- / hydroxide	**1**	

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Question	Answer	Marks	Guidance
3(b)	**OR**		
3(b)(i)	Award one • for each correct answer (maximum available = 15). Maximum 7 marks.		**Check the supervisor's report**. If the supervisor's report identifies **FA 7** as $CrCl_3$ + $NaNO_3$ or $FeSO_4$ + $NaNO_3$, then follow the separate mark schemes provided. Otherwise use the mark scheme for **FA 7** as $Cr_2(SO_4)_3(aq)$ + $NaNO_3(aq)$. If a centre appears to be using $CrCl_3$ or $FeSO_4$, and there is nothing to indicate this on the supervisor's report, consult TL. Write ticks on script. The following information applies to all version of the mark scheme for **3(b)(i)**: **Additional tests**: use of additional reagent loses associated • **A** 'no (visible) reaction' for no change, or no ppt for any test except **FA 7** on heating with NaOH and **FA 7** Test 4 with HNO_3. **I** solid, residue, particles for ppt first time seen, then **A** **R** 'no observation' first time seen, then **A** **R** '—' every time seen **R** 'soluble' ppt first 2× seen, then **I** 'soluble' **I** 'ppt becomes soluble' (no mention of 'in excess') first time seen then **A** **I** 'ppt disappears' for dissolves first time seen then **A** **I** temperature changes throughout. **I** cloudy / milky solutions (if ppt also present)

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>3(b)(i)</td><td>Mark Scheme when FA 7 is $FeSO_4$ and $NaNO_3$ and FA 8 is NaOH</td><td></td><td></td></tr>
<tr><td></td><td>
<table>
<tr><th></th><th>FA 7</th><th>FA 8</th></tr>
<tr><td>Test 1
+ NaOH

+ heat

+ Al</td><td>green ppt *
insoluble in excess / (ppt) turns brown (on contact with air) *

dark brown / black ppt *

gas / NH_3 turns (damp red) litmus blue *</td><td>no change / no (visible) reaction

AND</td></tr>
<tr><td>Test 2
+ NH_3</td><td>green ppt
AND
insoluble in excess / (ppt) turns brown (in contact with air) *</td><td>no change / no (visible) reaction *</td></tr>
<tr><td>Test 3
+ $CuSO_4$</td><td>no change *</td><td>(pale) blue ppt *</td></tr>
</table>
</td><td>7</td><td>2 * = 1 mark (round down) (15 * available)

FA 7 R grey-green ppt for green ppt every time.
A red-brown / rust ppt for brown ppt

FA 7 Test 1 I condensation on heating

FA 7 Test 1: There must be some reference to gas before testing with litmus paper to award the •

Any incorrect gas test anywhere in FA 7 Test 1 CONs the ammonia test blob (including a positive NH_3 test before the addition of Al). But I a positive test for H_2 after addition of Al.

FA 8 Test 3: ‘soluble in excess’ CONs the ‘blue ppt’ •

FA 8 Test 4 with Ba^{2+} : I solubility of ppt

FA 7 Test 4 with HNO_3: If ‘white ppt’ observed with Ba^{2+},
A white ppt, so long as there is no indication of change.
FA 8 Test 4 with Ba^{2+} : A ‘white ppt soluble in excess’ in box 1 and ‘no change’ in box 2.

FA 8 Test 4 with HNO_3: A soluble. I fizzing. If a white ppt was observed in test 4 part 1, R no change with HNO_3

FA 8 Test 5: A white / off-white / cream / any shade of brown ppt. R other colours with brown, e.g. yellow-brown</td></tr>
</table>

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>3(b)(i)</td><td>
<table>
<tr><th></th><th>FA 7</th><th>FA 8</th></tr>
<tr><td>Test 4
+ Ba^{2+}(aq)</td><td>white ppt *</td><td>no change OR (faint) white ppt

AND</td></tr>
<tr><td>+ HNO_3</td><td>no change / ppt insoluble *</td><td>no change OR (faint white) ppt dissolves / forms colourless solution *</td></tr>
<tr><td>Test 5
+ $AgNO_3$(aq)</td><td>no change *</td><td>white-brown ppt (insoluble in excess)</td></tr>
<tr><td>Test 6
+ FA 8</td><td>green ppt * insoluble in excess / (ppt) turns brown (on contact with air) *</td><td></td></tr>
</table>
2 * = 1 mark</td><td></td><td></td></tr>
<tr><td>3(b)(ii)</td><td>Cations in FA 7 and FA 8
FA 7 Fe^{2+} / iron(II)

and

FA 8 unknown *</td><td>1</td><td>A Fe^{+2}
R if Table 3.1 is completely blank</td></tr>
</table>

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Question	Answer	Marks	Guidance
3(b)(iii)	M1: M1: NO_2^- / nitrite and / or NO_3^- / nitrate **and** NH_3 liberated on heating with (NaOH /) A*l* or (OH^- /) A*l*	**1**	**CHECK TABLE 3.1 WHILE MARKING 3(b)(iii)** If more than two anions are identified, mark the first two. (NO_2^- and NO_3^- do not count as separate anions for this purpose). If formula is given for a reagent, it must be correct, e.g. **R** $BaNO_3$ **A** any clear reference to the reaction using (hot NaOH(aq) and) A*l* e.g. 'due to the results from (NaOH and) A*l*' or reference to test 1 and text from their answer to **3(b)(i)** that directly links to Test 1 box 3. **R M1** if no attempt to describe a positive test for NH_3 in **Table 3.1** Test 1 box 3 **R** additional tests to distinguish NO_2^- from NO_3^- unless already rejected in **3(b)(i)**
	M2: SO_4^{2-} / sulfate **and** ppt with barium nitrate / Ba^{2+} that is insoluble in (nitric) acid	**1**	**R M2** if **Table 3.1** Test 4 does **not** show a ppt that is insoluble in acid. If neither mark awarded, **A** 1 mark for NO_2^- / NO_3^- AND SO_4^{2-} (with incorrect / missing explanations). Additional ions CON this mark.
3(b)(iv)	OH^- / hydroxide	**1**	

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