Cambridge Assessment International Education

# Cambridge International AS & A Level

**CHEMISTRY** **9701/31**

Paper 3 Advanced Practical Skills 1 **October/November 2021**

CONFIDENTIAL INSTRUCTIONS

*6725462172*

**This document gives details of how to prepare for and administer the practical exam.**

**The information in this document and the identity of any materials supplied by Cambridge International are confidential and must NOT reach candidates either directly or indirectly.**

**The supervisor must complete the report at the end of this document and return it with the scripts.**

**INSTRUCTIONS**

- If you have any queries regarding these confidential instructions, contact Cambridge International stating the centre number, the syllabus and component number and the nature of the query.
  email info@cambridgeinternational.org
  phone +44 1223 553554

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# General information about practical exams

Centres must follow the guidance on science practical exams given in the *Cambridge Handbook*.

## Safety

Supervisors must follow national and local regulations relating to safety and first aid.

Only those procedures described in the question paper should be attempted.

Supervisors must inform candidates that materials and apparatus used in the exam should be treated with caution. Suitable eye protection should be used where necessary.

The following hazard codes are used in these confidential instructions, where relevant:

| | | | |
|---|---|---|---|
| **C** | corrosive | **MH** | moderate hazard |
| **HH** | health hazard | **T** | acutely toxic |
| **F** | flammable | **O** | oxidising |
| **N** | hazardous to the aquatic environment | | |

Hazard data sheets relating to substances used in this exam should be available from your chemical supplier.

## Before the exam

- The packets containing the question papers must **not** be opened before the exam.
- It is assumed that standard school laboratory facilities, as indicated in the *Guide to Planning Practical Science*, will be available.
- Spare materials and apparatus for the tasks set must be available for candidates, if required.

## During the exam

- It must be made clear to candidates at the start of the exam that they may request spare materials and apparatus for the tasks set.
- Where specified, the supervisor **must** perform the experiments and record the results as instructed. This must be done **out of sight** of the candidates, using the same materials and apparatus as the candidates.
- Any assistance provided to candidates must be recorded in the supervisor's report.
- If any materials or apparatus need to be replaced, for example, in the event of breakage or loss, this must be recorded in the supervisor's report.

## After the exam

- The supervisor must complete a report for each practical session held and each laboratory used.
- Each packet of scripts returned to Cambridge International must contain the following items:
  - the scripts of the candidates specified on the bar code label provided
  - the supervisor's results relevant to these candidates
  - the supervisor's reports relevant to these candidates
  - seating plans for each practical session, referring to each candidate by candidate number
  - the attendance register.

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## Specific information for this practical exam

During the exam, the supervisor (**not** the invigilator) must do all the experiments and record the results on a spare copy of the question paper, clearly labelled 'supervisor's results'.
If chemicals are prepared in more than one batch, clearly labelled supervisor's results must be provided for each batch. The candidates using each batch must be listed on the supervisor's report.

**Apparatus**

The apparatus listed must be provided to each candidate.

1 × 50 $cm^3$ burette
1 × 25 $cm^3$ pipette
1 × pipette filler
1 × burette stand and clamp
1 × funnel (for filling burette)
1 × white tile
2 × 150 $cm^3$ or 250 $cm^3$ conical flask
1 × 100 $cm^3$ beaker
1 × 250 $cm^3$ beaker
1 × 250 $cm^3$ volumetric flask
1 × crucible with lid (approximate capacity 15 $cm^3$)
1 × crucible tongs
1 × pipe-clay triangle
1 × tripod
1 × gauze
1 × Bunsen burner
1 × heatproof mat
1 × spatula
1 × glass rod
8 × test-tube*
1 × boiling tube
1 × test-tube holder
1 × test-tube rack
1 × stop-clock to measure to an accuracy of 1 second
2 × teat/dropping pipette
1 × wash bottle of distilled water
1 × pen suitable for labelling glassware
paper towels
access to a balance weighing to at least 0.1 g
red and blue litmus papers
aluminium foil for testing nitrate/nitrite
wooden splints
the apparatus normally used in the centre for use with limewater in testing for carbon dioxide

*Candidates are expected to rinse and reuse test-tubes and boiling tubes where possible.
Additional tubes should be available.

**Where balance provision is limited, some candidates should be instructed to start the exam with different questions. See the current syllabus for balance : candidate ratio.**

## Materials

The materials listed in the table must be provided to each candidate.

| label | per candidate | identity | notes |
|---|---|---|---|
| **FA 1 [MH]** | 1.8–2.2 g | hydrated sodium carbonate | 1.8 g–2.2 g of $Na_2CO_3 \cdot 10H_2O$ **[MH]** supplied in a stoppered container. |
| **FA 2 [C]** | 50 $cm^3$ | 1.00 mol $dm^{-3}$ sodium hydroxide | Dissolve 40.0 g NaOH **[C]** in each $dm^3$ of solution. |
| **FA 3** | 120 $cm^3$ | 0.0500 mol $dm^{-3}$ sulfuric acid | Dilute 1.00 mol $dm^{-3}$ $H_2SO_4$ **[MH]** (prepared as the current syllabus) 50.0 $cm^3$ in each $dm^3$ of solution. |
| **FA 5** | 20 $cm^3$ | 0.10 mol $dm^{-3}$ barium chloride | See preparation instructions in the current syllabus. |
| **FA 6 [MH]** | 20 $cm^3$ | 1.0 mol $dm^{-3}$ sulfuric acid | See preparation instructions in the current syllabus. |
| **FA 7 [C]** | 20 $cm^3$ | 1.0 mol $dm^{-3}$ sodium hydroxide | See preparation instructions in the current syllabus. 2 mol $dm^{-3}$, dilute 500 $cm^3$ for each $dm^3$. |
| **FA 8 [MH]** | 20 $cm^3$ | 1.0 mol $dm^{-3}$ methanoic acid | Dilute 46.0 g of HCOOH **[C]** in each $dm^3$ of solution. |
| **bromophenol blue indicator [F][MH][HH]** | 10 $cm^3$ | bromophenol blue indicator | See preparation instructions in the current syllabus. |
| **magnesium chloride** | 10 $cm^3$ | 0.5 mol $dm^{-3}$ magnesium chloride | Dissolve 47.5 g $MgCl_2$ or 101.5 g $MgCl_2 \cdot 6H_2O$ in each $dm^3$ of solution. |
| **sodium carbonate** | 10 $cm^3$ | 0.5 mol $dm^{-3}$ sodium carbonate | Dissolve 53.0 g $Na_2CO_3$ **[MH]** or 143.0 g $Na_2CO_3 \cdot 10H_2O$ **[MH]** in each $dm^3$ of solution. |
| **ammonium chloride [MH]** | 0.5 g | ammonium chloride | Provide approximately 0.5 g $NH_4Cl$ **[MH]** in a stoppered container. |
| **copper(II) sulfate [C][N]** | 10 $cm^3$ | 0.2 mol $dm^{-3}$ copper(II) sulfate | Dissolve 49.9 g of $CuSO_4 \cdot 5H_2O$ **[C][MH][N]** in each $dm^3$ of solution. |
| **magnesium [F]** | 2 × 1 cm lengths | magnesium ribbon | 2 × approximately 1 cm lengths of Mg ribbon **[F]** |

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| label | per candidate | identity | notes |
|---|---|---|---|
| dilute hydrochloric acid | 10 $cm^3$ | 2.0 mol $dm^{-3}$ $HCl$ | See preparation instructions in the current syllabus.<br><br>If necessary, each of these reagents can be provided as a communal supply for groups of up to 6 candidates.<br><br>Invigilators must be alert to the risk of contamination and the opportunity for malpractice when using a communal supply. |
| dilute nitric acid **[C]** | 10 $cm^3$ | 2.0 mol $dm^{-3}$ $HNO_3$ | |
| dilute sulfuric acid **[MH]** | 10 $cm^3$ | 1.0 mol $dm^{-3}$ $H_2SO_4$ | |
| aqueous ammonia **[C][MH][N]** | 10 $cm^3$ | 2.0 mol $dm^{-3}$ $NH_3$ | |
| aqueous sodium hydroxide **[C]** | 10 $cm^3$ | 2.0 mol $dm^{-3}$ NaOH | |
| aqueous barium chloride<br>or<br>aqueous barium nitrate | 10 $cm^3$ | 0.1 mol $dm^{-3}$ $BaCl_2$<br>or<br>0.1 mol $dm^{-3}$ $Ba(NO_3)_2$ | |
| limewater **[MH]** | 10 $cm^3$ | saturated aqueous calcium hydroxide, $Ca(OH)_2$ | |
| aqueous silver nitrate | 10 $cm^3$ | 0.05 mol $dm^{-3}$ $AgNO_3$ | |
| aqueous acidified potassium manganate(VII) **[MH]** | 10 $cm^3$ | 0.01 mol $dm^{-3}$ $KMnO_4$ in 0.5 mol $dm^{-3}$ $H_2SO_4$ | |

- An excess of at least 10% of each material must be prepared to cover accidental loss.
- All solutions must be thoroughly mixed.
- If you are unable to source any of these chemicals, you must contact Cambridge International as far as possible in advance of the exam for advice.
- **Materials must be labelled only as specified in the 'label' column. The identities of chemicals labelled with letter codes, e.g. FA 1, may be different from their descriptions in the question paper. Candidates must use the descriptions given in the question paper.**

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## Supervisor's report

| Syllabus and component number | | | | | / | | |
|---|---|---|---|---|---|---|---|

| Centre number | | | | | |
|---|---|---|---|---|---|

Centre name .....

Time of the practical session .....

Laboratory name/number .....

**Give details of any difficulties experienced by the centre or by candidates (include the relevant candidate names and candidate numbers).**

You must include:
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- any difficulties experienced by candidates, e.g. due to faulty materials or apparatus
- any specific assistance given to candidates.

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**If chemicals have been prepared in more than one batch, list the candidates using each batch.**

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3 I have included details of difficulties relating to each practical session experienced by the centre or by candidates.

4 I have reported any other adverse circumstances affecting candidates, e.g. illness, bereavement or temporary injury, directly to Cambridge International on a *special consideration form*.

Signed ..... (supervisor)

Name (in block capitals) .....

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Cambridge Assessment International Education

# Cambridge International AS & A Level

**CHEMISTRY** **9701/33**

Paper 3 Advanced Practical Skills 1 **October/November 2021**

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1 × 25 $cm^3$ pipette
1 × pipette filler
1 × 25 $cm^3$ measuring cylinder
1 × burette stand and clamp
1 × funnel (for filling burette)
1 × white tile
2 × 150 $cm^3$ or 250 $cm^3$ conical flask
1 × 100 $cm^3$ beaker
1 × Bunsen burner
1 × heatproof mat
1 × spatula
1 × glass rod
8 × test-tube*
2 × boiling tube*
1 × hard-glass test-tube
1 × test-tube holder
1 × test-tube rack
2 × teat/dropping pipette
1 × wash bottle of distilled water
1 × pen suitable for labelling glassware
paper towels
access to a balance weighing to **at least** 0.1 g
red and blue litmus papers
wooden splints
the apparatus normally used in the centre for use with limewater in testing for carbon dioxide
aluminium foil for testing nitrate/nitrite

*Candidates are expected to rinse and reuse test-tubes and boiling tubes where possible.
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## Materials

The materials listed in the table must be provided to each candidate.

| label | per candidate | identity | notes |
|---|---|---|---|
| **FA 1 [MH]** | 1.35 g | lithium carbonate | Provide 1.35 ± 0.05 g of $Li_2CO_3$ **[MH]** in a stoppered container. |
| **FA 2** | 30 $cm^3$ | 2.0 mol $dm^{-3}$ hydrochloric acid | See preparation instructions in the current syllabus. |
| **FA 3** | 150 $cm^3$ | 0.0540 mol $dm^{-3}$ sodium carbonate | Dissolve 5.72 g of $Na_2CO_3$ **[MH]** or 15.44 g of $Na_2CO_3 \cdot 10H_2O$ **[MH]** in each $dm^3$ of solution. |
| **FA 4** | 150 $cm^3$ | 0.110 mol $dm^{-3}$ hydrochloric acid | Dilute 55.0 $cm^3$ of 2.0 mol $dm^{-3}$ $HCl$ to 1 $dm^3$. For 2.0 mol $dm^{-3}$ $HCl$ see preparation instructions in the current syllabus. |
| **FA 5 [MH]** | 1 g | ammonium carbonate | Provide 1 g of $(NH_4)_2CO_3$ **[MH]** in a stoppered container. |
| **FA 7** | 15 $cm^3$ | 0.2 mol $dm^{-3}$ chromium(III) potassium sulfate | Dissolve 100 g of $CrK(SO_4)_2 \cdot 12H_2O$ **[MH]** in each $dm^3$ of solution. This may be supplied as chrome alum. |
| **FA 8** | 15 $cm^3$ | 0.1 mol $dm^{-3}$ barium chloride | See preparation instructions in the current syllabus. |
| **bromophenol blue indicator [F][HH][MH]** | 5 $cm^3$ | bromophenol blue indicator | See preparation instructions in the current syllabus. |

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| label | per candidate | identity | notes |
|---|---|---|---|
| dilute hydrochloric acid | 10 $cm^3$ | 2.0 mol $dm^{-3}$ $HCl$ | See preparation instructions in the current syllabus.<br><br>If necessary, each of these reagents can be provided as a communal supply for groups of up to 6 candidates.<br><br>Invigilators must be alert to the risk of contamination and the opportunity for malpractice when using a communal supply. |
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| aqueous ammonia **[C][MH][N]** | 10 $cm^3$ | 2.0 mol $dm^{-3}$ $NH_3$ | |
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Signed ..... (supervisor)

Name (in block capitals) .....

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# Cambridge International AS & A Level

**CHEMISTRY** **9701/34**

Paper 3 Advanced Practical Skills 2 **October/November 2021**

CONFIDENTIAL INSTRUCTIONS

*5509191188*

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The apparatus listed must be provided to each candidate.

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1 × 50 $cm^3$ measuring cylinder
1 × 25 $cm^3$ measuring cylinder
2 × burette stand and clamp
2 × funnel for filling burette
1 × 100 $cm^3$ beaker
1 × stop-clock or sight of a clock to measure to an accuracy of 1 s
1 × 250 $cm^3$ beaker
1 × glass rod
1 × spatula
1 × plastic (expanded polystyrene) or paper cup approximately 150 $cm^3$
1 × thermometer (–10 °C to +110 °C at 1 °C)
1 × boiling tube*
6 × test-tube*
2 × hard-glass test-tube
1 × test-tube rack
1 × test-tube holder
2 × teat/dropping pipette
1 × Bunsen burner
1 × heatproof mat
1 × pen (for labelling glassware)
1 × wash bottle of distilled water
paper towels
access to a balance weighing to **at least** 0.1 g
red and blue litmus papers
aluminium foil for testing nitrate/nitrite
wooden splints
the apparatus normally used in the centre for use with limewater in testing for carbon dioxide

*Candidates are expected to rinse and reuse test-tubes and boiling tubes where possible.
Additional tubes should be available.

*Per five candidates*
A bucket labelled **Quenching bath** must be provided.
The bucket must contain 1 $dm^3$ of 5% sodium carbonate solution (made up by dissolving 50 g of $Na_2CO_3$ **[MH]** or 135 g of $Na_2CO_3 \cdot 10H_2O$ **[MH]** in 1 $dm^3$ of water) and adequate universal indicator for monitoring of pH.
The supervisor must monitor the colour of the universal indicator in each quenching bath to check that the solution has **not** become acidic. If the solution becomes acidic, the supervisor must add more 5% sodium carbonate solution to the quenching bath.

## Materials

The materials listed in the table must be provided to each candidate.

**Warning:** small amounts of $SO_2$ **[C][T]**, which can cause respiratory distress in some people, may be produced. **The laboratory must be well ventilated.**

| label | per candidate | identity | notes |
|---|---|---|---|
| **FB 1** | 200 $cm^3$ | 0.100 mol $dm^{-3}$ sodium thiosulfate | Dissolve 24.82 g of $Na_2S_2O_3 \cdot 5H_2O$ in each $dm^3$ of solution. |
| **FB 2** | 75 $cm^3$ | 2.00 mol $dm^{-3}$ hydrochloric acid | See preparation instructions in the current syllabus. |
| **FB 3 [F][N]** | 2 g | zinc powder | 2.0 ± 0.1 g of zinc powder **[F][N]** in a stoppered container (fresh supply). |
| **FB 4 [C][MH]** | 60 $cm^3$ | 0.650 mol $dm^{-3}$ copper(II) sulfate | Dissolve 162.3 g of $CuSO_4 \cdot 5H_2O$ **[C][MH][N]** in each $dm^3$ of solution. |
| **FB 5 [MH]** | 25 $cm^3$ | 0.20 mol $dm^{-3}$ iron(II) ammonium sulfate | Dissolve 78.4 g of $(NH_4)_2Fe(SO_4)_2 \cdot 6H_2O$ **[MH]** in each $dm^3$ of 0.5 mol $dm^{-3}$ sulfuric acid.<br>To prepare 0.5 mol $dm^{-3}$ $H_2SO_4$ dilute 500 $cm^3$ of 1.0 mol $dm^{-3}$ **[MH]** to 1 $dm^3$. (See preparation instructions in the current syllabus.) |
| **FB 6 [O][MH]** | 1 g | sodium nitrate | 1.0 ± 0.2 g of $NaNO_3$ **[O][MH]** in a stoppered container. |
| **FB 7 [MH]** | 1 g | ammonium chloride | 1.0 ± 0.2 g of $NH_4Cl$ **[MH]** in a stoppered container. |
| **magnesium strips [F]** | 2 × 1 cm | magnesium ribbon | Each candidate should be provided with 2 × 1 cm strip of magnesium ribbon **[F]**. |
| **aqueous sodium carbonate [MH]** | 10 $cm^3$ | 1.0 mol $dm^{-3}$ sodium carbonate | Dissolve 106.0 g of $Na_2CO_3$ **[MH]** or 286.1 g of $Na_2CO_3 \cdot 10H_2O$ **[MH]** in each $dm^3$ of solution. |
| **distilled water** | 125 $cm^3$ | distilled water | |

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|---|---|---|---|
| dilute hydrochloric acid | 10 $cm^3$ | 2.0 mol $dm^{-3}$ $HCl$ | See preparation instructions in the current syllabus.<br><br>If necessary, each of these reagents can be provided as a communal supply for groups of up to 6 candidates.<br><br>Invigilators must be alert to the risk of contamination and the opportunity for malpractice when using a communal supply. |
| dilute nitric acid **[C]** | 10 $cm^3$ | 2.0 mol $dm^{-3}$ $HNO_3$ | |
| dilute sulfuric acid **[MH]** | 10 $cm^3$ | 1.0 mol $dm^{-3}$ $H_2SO_4$ | |
| aqueous ammonia **[C][MH][N]** | 10 $cm^3$ | 2.0 mol $dm^{-3}$ $NH_3$ | |
| aqueous sodium hydroxide **[C]** | 10 $cm^3$ | 2.0 mol $dm^{-3}$ NaOH | |
| aqueous barium chloride<br>or<br>aqueous barium nitrate | 10 $cm^3$ | 0.1 mol $dm^{-3}$ $BaCl_2$<br>or<br>0.1 mol $dm^{-3}$ $Ba(NO_3)_2$ | |
| limewater **[MH]** | 10 $cm^3$ | saturated aqueous calcium hydroxide, $Ca(OH)_2$ | |
| aqueous silver nitrate | 10 $cm^3$ | 0.05 mol $dm^{-3}$ $AgNO_3$ | |
| aqueous acidified potassium manganate(VII) **[MH]** | 10 $cm^3$ | 0.01 mol $dm^{-3}$ $KMnO_4$ in 0.5 mol $dm^{-3}$ $H_2SO_4$ | |

- An excess of at least 10% of each material must be prepared to cover accidental loss.
- All solutions must be thoroughly mixed.
- If you are unable to source any of these chemicals, you must contact Cambridge International as far as possible in advance of the exam for advice.
- **Materials must be labelled only as specified in the 'label' column. The identities of chemicals labelled with letter codes, e.g. FB 1, may be different from their descriptions in the question paper. Candidates must use the descriptions given in the question paper.**

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## Supervisor's report

| Syllabus and component number | | | | | / | | |
|---|---|---|---|---|---|---|---|

| Centre number | | | | | |
|---|---|---|---|---|---|

Centre name .....

Time of the practical session .....

Laboratory name/number .....

**Give details of any difficulties experienced by the centre or by candidates (include the relevant candidate names and candidate numbers).**

You must include:
- any difficulties experienced by the centre in the preparation of materials
- any difficulties experienced by candidates, e.g. due to faulty materials or apparatus
- any specific assistance given to candidates.

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**If chemicals have been prepared in more than one batch, list the candidates using each batch.**

## Declaration

1 Each packet that I am returning to Cambridge International contains all of the following items:
- the scripts of the candidates specified on the bar code label provided
- the supervisor's results relevant to these candidates
- the supervisor's reports relevant to these candidates
- seating plans for each practical session, referring to each candidate by candidate number
- the attendance register.

2 Where the practical exam has taken place in more than one practical session, I have clearly labelled the supervisor's results, supervisor's reports and seating plans with the time and laboratory name/number for each practical session.

3 I have included details of difficulties relating to each practical session experienced by the centre or by candidates.

4 I have reported any other adverse circumstances affecting candidates, e.g. illness, bereavement or temporary injury, directly to Cambridge International on a *special consideration form*.

Signed ..... (supervisor)

Name (in block capitals) .....

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Cambridge Assessment International Education

# Cambridge International AS & A Level

**CHEMISTRY** **9701/35**

Paper 3 Advanced Practical Skills 1 **October/November 2021**

CONFIDENTIAL INSTRUCTIONS

*7623845820*

**This document gives details of how to prepare for and administer the practical exam.**

**The information in this document and the identity of any materials supplied by Cambridge International are confidential and must NOT reach candidates either directly or indirectly.**

**The supervisor must complete the report at the end of this document and return it with the scripts.**

**INSTRUCTIONS**

- If you have any queries regarding these confidential instructions, contact Cambridge International stating the centre number, the syllabus and component number and the nature of the query.
  email info@cambridgeinternational.org
  phone +44 1223 553554

This document has **8** pages. Any blank pages are indicated.


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# General information about practical exams

Centres must follow the guidance on science practical exams given in the *Cambridge Handbook*.

## Safety

Supervisors must follow national and local regulations relating to safety and first aid.

Only those procedures described in the question paper should be attempted.

Supervisors must inform candidates that materials and apparatus used in the exam should be treated with caution. Suitable eye protection should be used where necessary.

The following hazard codes are used in these confidential instructions, where relevant:

| | | | |
|---|---|---|---|
| **C** | corrosive | **MH** | moderate hazard |
| **HH** | health hazard | **T** | acutely toxic |
| **F** | flammable | **O** | oxidising |
| **N** | hazardous to the aquatic environment | | |

Hazard data sheets relating to substances used in this exam should be available from your chemical supplier.

## Before the exam

- The packets containing the question papers must **not** be opened before the exam.
- It is assumed that standard school laboratory facilities, as indicated in the *Guide to Planning Practical Science*, will be available.
- Spare materials and apparatus for the tasks set must be available for candidates, if required.

## During the exam

- It must be made clear to candidates at the start of the exam that they may request spare materials and apparatus for the tasks set.
- Where specified, the supervisor **must** perform the experiments and record the results as instructed. This must be done **out of sight** of the candidates, using the same materials and apparatus as the candidates.
- Any assistance provided to candidates must be recorded in the supervisor's report.
- If any materials or apparatus need to be replaced, for example, in the event of breakage or loss, this must be recorded in the supervisor's report.

## After the exam

- The supervisor must complete a report for each practical session held and each laboratory used.
- Each packet of scripts returned to Cambridge International must contain the following items:
  - the scripts of the candidates specified on the bar code label provided
  - the supervisor's results relevant to these candidates
  - the supervisor's reports relevant to these candidates
  - seating plans for each practical session, referring to each candidate by candidate number
  - the attendance register.

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## Specific information for this practical exam

During the exam, the supervisor (**not** the invigilator) must do all the experiments and record the results on a spare copy of the question paper, clearly labelled 'supervisor's results'.
If chemicals are prepared in more than one batch, clearly labelled supervisor's results must be provided for each batch. The candidates using each batch must be listed on the supervisor's report.

**Apparatus**

The apparatus listed must be provided to each candidate.

1 × 50 $cm^3$ burette
1 × 25 $cm^3$ pipette
1 × pipette filler
1 × burette stand and clamp
1 × funnel (for filling burette)
1 × white tile
2 × 150 $cm^3$ or 250 $cm^3$ conical flask
1 × 100 $cm^3$ beaker
1 × 250 $cm^3$ beaker
1 × 250 $cm^3$ volumetric flask
1 × crucible with lid (approximate capacity 15 $cm^3$)
1 × crucible tongs
1 × pipe-clay triangle
1 × tripod
1 × gauze
1 × Bunsen burner
1 × heatproof mat
1 × spatula
1 × glass rod
8 × test-tube*
1 × boiling tube
1 × test-tube holder
1 × test-tube rack
1 × stop-clock to measure to an accuracy of 1 second
2 × teat/dropping pipette
1 × wash bottle of distilled water
1 × pen suitable for labelling glassware
paper towels
access to a balance weighing to at least 0.1 g
red and blue litmus papers
aluminium foil for testing nitrate/nitrite
wooden splints
the apparatus normally used in the centre for use with limewater in testing for carbon dioxide

*Candidates are expected to rinse and reuse test-tubes and boiling tubes where possible.
Additional tubes should be available.

**Where balance provision is limited, some candidates should be instructed to start the exam with different questions. See the current syllabus for balance : candidate ratio.**

## Materials

The materials listed in the table must be provided to each candidate.

| label | per candidate | identity | notes |
|---|---|---|---|
| **FA 1 [MH]** | 1.8–2.2 g | hydrated sodium carbonate | 1.8 g–2.2 g of $Na_2CO_3 \cdot 10H_2O$ **[MH]** supplied in a stoppered container. |
| **FA 2 [C]** | 50 $cm^3$ | 1.00 mol $dm^{-3}$ sodium hydroxide | Dissolve 40.0 g NaOH **[C]** in each $dm^3$ of solution. |
| **FA 3** | 120 $cm^3$ | 0.0500 mol $dm^{-3}$ sulfuric acid | Dilute 1.00 mol $dm^{-3}$ $H_2SO_4$ **[MH]** (prepared as the current syllabus) 50.0 $cm^3$ in each $dm^3$ of solution. |
| **FA 5** | 20 $cm^3$ | 0.10 mol $dm^{-3}$ barium chloride | See preparation instructions in the current syllabus. |
| **FA 6 [MH]** | 20 $cm^3$ | 1.0 mol $dm^{-3}$ sulfuric acid | See preparation instructions in the current syllabus. |
| **FA 7 [C]** | 20 $cm^3$ | 1.0 mol $dm^{-3}$ sodium hydroxide | See preparation instructions in the current syllabus. 2 mol $dm^{-3}$, dilute 500 $cm^3$ for each $dm^3$. |
| **FA 8 [MH]** | 20 $cm^3$ | 1.0 mol $dm^{-3}$ methanoic acid | Dilute 46.0 g of HCOOH **[C]** in each $dm^3$ of solution. |
| **bromophenol blue indicator [F][MH][HH]** | 10 $cm^3$ | bromophenol blue indicator | See preparation instructions in the current syllabus. |
| **magnesium chloride** | 10 $cm^3$ | 0.5 mol $dm^{-3}$ magnesium chloride | Dissolve 47.5 g $MgCl_2$ or 101.5 g $MgCl_2 \cdot 6H_2O$ in each $dm^3$ of solution. |
| **sodium carbonate** | 10 $cm^3$ | 0.5 mol $dm^{-3}$ sodium carbonate | Dissolve 53.0 g $Na_2CO_3$ **[MH]** or 143.0 g $Na_2CO_3 \cdot 10H_2O$ **[MH]** in each $dm^3$ of solution. |
| **ammonium chloride [MH]** | 0.5 g | ammonium chloride | Provide approximately 0.5 g $NH_4Cl$ **[MH]** in a stoppered container. |
| **copper(II) sulfate [C][N]** | 10 $cm^3$ | 0.2 mol $dm^{-3}$ copper(II) sulfate | Dissolve 49.9 g of $CuSO_4 \cdot 5H_2O$ **[C][MH][N]** in each $dm^3$ of solution. |
| **magnesium [F]** | 2 × 1 cm lengths | magnesium ribbon | 2 × approximately 1 cm lengths of Mg ribbon **[F]** |

| label | per candidate | identity | notes |
|---|---|---|---|
| dilute hydrochloric acid | 10 $cm^3$ | 2.0 mol $dm^{-3}$ $HCl$ | See preparation instructions in the current syllabus.<br><br>If necessary, each of these reagents can be provided as a communal supply for groups of up to 6 candidates.<br><br>Invigilators must be alert to the risk of contamination and the opportunity for malpractice when using a communal supply. |
| dilute nitric acid **[C]** | 10 $cm^3$ | 2.0 mol $dm^{-3}$ $HNO_3$ | |
| dilute sulfuric acid **[MH]** | 10 $cm^3$ | 1.0 mol $dm^{-3}$ $H_2SO_4$ | |
| aqueous ammonia **[C][MH][N]** | 10 $cm^3$ | 2.0 mol $dm^{-3}$ $NH_3$ | |
| aqueous sodium hydroxide **[C]** | 10 $cm^3$ | 2.0 mol $dm^{-3}$ NaOH | |
| aqueous barium chloride<br>or<br>aqueous barium nitrate | 10 $cm^3$ | 0.1 mol $dm^{-3}$ $BaCl_2$<br>or<br>0.1 mol $dm^{-3}$ $Ba(NO_3)_2$ | |
| limewater **[MH]** | 10 $cm^3$ | saturated aqueous calcium hydroxide, $Ca(OH)_2$ | |
| aqueous silver nitrate | 10 $cm^3$ | 0.05 mol $dm^{-3}$ $AgNO_3$ | |
| aqueous acidified potassium manganate(VII) **[MH]** | 10 $cm^3$ | 0.01 mol $dm^{-3}$ $KMnO_4$ in 0.5 mol $dm^{-3}$ $H_2SO_4$ | |

- An excess of at least 10% of each material must be prepared to cover accidental loss.
- All solutions must be thoroughly mixed.
- If you are unable to source any of these chemicals, you must contact Cambridge International as far as possible in advance of the exam for advice.
- **Materials must be labelled only as specified in the 'label' column. The identities of chemicals labelled with letter codes, e.g. FA 1, may be different from their descriptions in the question paper. Candidates must use the descriptions given in the question paper.**

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## Supervisor's report

| Syllabus and component number | | | | | / | | |
|---|---|---|---|---|---|---|---|

| Centre number | | | | | |
|---|---|---|---|---|---|

Centre name .....

Time of the practical session .....

Laboratory name/number .....

**Give details of any difficulties experienced by the centre or by candidates (include the relevant candidate names and candidate numbers).**

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## Declaration

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- seating plans for each practical session, referring to each candidate by candidate number
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4 I have reported any other adverse circumstances affecting candidates, e.g. illness, bereavement or temporary injury, directly to Cambridge International on a *special consideration form*.

Signed ..... (supervisor)

Name (in block capitals) .....

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Cambridge Assessment International Education

# Cambridge International AS & A Level

**CHEMISTRY** **9701/36**

Paper 3 Advanced Practical Skills 2 **October/November 2021**

CONFIDENTIAL INSTRUCTIONS

**This document gives details of how to prepare for and administer the practical exam.**

**The information in this document and the identity of any materials supplied by Cambridge International are confidential and must NOT reach candidates either directly or indirectly.**

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## INSTRUCTIONS

- If you have any queries regarding these confidential instructions, contact Cambridge International stating the centre number, the syllabus and component number and the nature of the query.
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  phone +44 1223 553554

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# General information about practical exams

Centres must follow the guidance on science practical exams given in the *Cambridge Handbook*.

## Safety

Supervisors must follow national and local regulations relating to safety and first aid.

Only those procedures described in the question paper should be attempted.

Supervisors must inform candidates that materials and apparatus used in the exam should be treated with caution. Suitable eye protection should be used where necessary.

The following hazard codes are used in these confidential instructions, where relevant:

| | | | |
|---|---|---|---|
| **C** | corrosive | **MH** | moderate hazard |
| **HH** | health hazard | **T** | acutely toxic |
| **F** | flammable | **O** | oxidising |
| **N** | hazardous to the aquatic environment | | |

Hazard data sheets relating to substances used in this exam should be available from your chemical supplier.

## Before the exam

- The packets containing the question papers must **not** be opened before the exam.
- It is assumed that standard school laboratory facilities, as indicated in the *Guide to Planning Practical Science*, will be available.
- Spare materials and apparatus for the tasks set must be available for candidates, if required.

## During the exam

- It must be made clear to candidates at the start of the exam that they may request spare materials and apparatus for the tasks set.
- Where specified, the supervisor **must** perform the experiments and record the results as instructed. This must be done **out of sight** of the candidates, using the same materials and apparatus as the candidates.
- Any assistance provided to candidates must be recorded in the supervisor's report.
- If any materials or apparatus need to be replaced, for example, in the event of breakage or loss, this must be recorded in the supervisor's report.

## After the exam

- The supervisor must complete a report for each practical session held and each laboratory used.
- Each packet of scripts returned to Cambridge International must contain the following items:
  - the scripts of the candidates specified on the bar code label provided
  - the supervisor's results relevant to these candidates
  - the supervisor's reports relevant to these candidates
  - seating plans for each practical session, referring to each candidate by candidate number
  - the attendance register.

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## Specific information for this practical exam

During the exam, the supervisor (**not** the invigilator) must do all the experiments and record the results on a spare copy of the question paper, clearly labelled 'supervisor's results'.
If chemicals are prepared in more than one batch, clearly labelled supervisor's results must be provided for each batch. The candidates using each batch must be listed on the supervisor's report.

**Apparatus**

The apparatus listed must be provided to each candidate.

1 × 25.0 $cm^3$ pipette
1 × pipette filler
2 × 50 $cm^3$ burette
2 × burette stand and clamp
2 × funnel (for filling burette and graduated flask)
1 × white tile
2 × 150 or 250 $cm^3$ conical flask
1 × 250 $cm^3$ graduated (volumetric) flask
1 × 250 $cm^3$ beaker
1 × stop-clock or sight of a clock to measure to an accuracy of 1 s
1 × stirring rod
1 × Bunsen burner
1 × heat-proof mat
1 × tripod
1 × pipe-clay triangle
1 × crucible tongs
1 × test-tube holder
1 × crucible with lid (approximate capacity 15 $cm^3$)
1 × filter funnel
1 × filter paper
1 × boiling tube
1 × hard-glass test-tube
8 × test-tube*
1 × test-tube rack
2 × teat/dropping pipette
1 × spatula
1 × wash bottle containing distilled water
1 × pen for labelling glassware
paper towels
access to a balance weighing to at least 0.1 g
red and blue litmus papers
aluminium foil for testing nitrate/nitrite
wooden splints
the apparatus normally used in the centre for use with limewater in testing for carbon dioxide

*Candidates are expected to rinse and reuse test-tubes and boiling tubes where possible.
Additional tubes should be available.

**Where balance provision is limited, some candidates should be instructed to start the exam with different questions. See the current syllabus for balance : candidate ratio.**

## Materials

The materials listed in the table must be provided to each candidate.

| label | per candidate | identity | notes |
|---|---|---|---|
| **FB 1 [MH]** | 2.0 g | hydrated sodium carbonate | Provide 2.0 ± 0.1 g $Na_2CO_3 \cdot 10H_2O$ **[MH]** in a stoppered container. This should be from a freshly opened container. |
| **FB 2** | 75 $cm^3$ | 0.8 mol $dm^{-3}$ hydrochloric acid | Prepare 2.0 mol $dm^{-3}$ $HCl$ according to the instructions in the current syllabus. 400 $cm^3$ of this solution should be used in each $dm^3$. |
| **FB 4** | 120 $cm^3$ | 0.11 mol $dm^{-3}$ sodium hydroxide | Dissolve 4.40 g NaOH **[C]** in each $dm^3$ of solution. |
| **FB 5 [MH]** | 1.5 g | hydrated sodium carbonate | Provide 1.5 ± 0.1 g $Na_2CO_3 \cdot 10H_2O$ **[MH]** in a stoppered container. This should be from a freshly opened container. |
| **FB 6 [MH]** | 0.5 g | manganese(IV) oxide **powder** | Provide approximately 0.5 g powdered $MnO_2$ **[MH]** supplied in a stoppered container. |
| **FB 7** | 10 $cm^3$ | 0.2 mol $dm^{-3}$ iron(II) sulfate | Dissolve 56 g of $FeSO_4 \cdot 7H_2O$ **[MH]** in 500 $cm^3$ distilled water and 50 $cm^3$ 1 mol $dm^{-3}$ sulfuric acid **[MH]** and dilute the solution with distilled water to 1 $dm^3$. This solution should be freshly prepared. |
| **FB 8 [MH]** | 1 g | ammonium chloride | Provide approximately 1.0 g of $NH_4Cl$ **[MH]** supplied in a stoppered container. |
| **distilled water** | 300 $cm^3$ | distilled water | |
| **hydrogen peroxide** | 10 $cm^3$ | 10 volume hydrogen peroxide | Dilute 100 $cm^3$ '100 volume' $H_2O_2$ **[C][O]** with distilled water to 1 $dm^3$. |
| **bromophenol blue indicator [F][MH][H]** | 5 $cm^3$ | bromophenol blue indicator | See preparation instructions in the current syllabus. |
| **potassium manganate(VII)** | 5 $cm^3$ | 0.02 mol $dm^{-3}$ potassium manganate(VII) | Dissolve 3.16 g of $KMnO_4$ **[O][MH][N]** in each $dm^3$ of solution. |

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| label | per candidate | identity | notes |
|---|---|---|---|
| dilute hydrochloric acid | 10 $cm^3$ | 2.0 mol $dm^{-3}$ $HCl$ | See preparation instructions in the current syllabus.<br><br>If necessary, each of these reagents can be provided as a communal supply for groups of up to 6 candidates.<br><br>Invigilators must be alert to the risk of contamination and the opportunity for malpractice when using a communal supply. |
| dilute nitric acid **[C]** | 10 $cm^3$ | 2.0 mol $dm^{-3}$ $HNO_3$ | |
| dilute sulfuric acid **[MH]** | 10 $cm^3$ | 1.0 mol $dm^{-3}$ $H_2SO_4$ | |
| aqueous ammonia **[C][MH][N]** | 10 $cm^3$ | 2.0 mol $dm^{-3}$ $NH_3$ | |
| aqueous sodium hydroxide **[C]** | 10 $cm^3$ | 2.0 mol $dm^{-3}$ NaOH | |
| aqueous barium chloride<br>or<br>aqueous barium nitrate | 10 $cm^3$ | 0.1 mol $dm^{-3}$ $BaCl_2$<br>or<br>0.1 mol $dm^{-3}$ $Ba(NO_3)_2$ | |
| limewater **[MH]** | 10 $cm^3$ | saturated aqueous calcium hydroxide, $Ca(OH)_2$ | |
| aqueous silver nitrate | 10 $cm^3$ | 0.05 mol $dm^{-3}$ $AgNO_3$ | |
| aqueous acidified potassium manganate(VII) **[MH]** | 10 $cm^3$ | 0.01 mol $dm^{-3}$ $KMnO_4$ in 0.5 mol $dm^{-3}$ $H_2SO_4$ | |

- An excess of at least 10% of each material must be prepared to cover accidental loss.
- All solutions must be thoroughly mixed.
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## Supervisor's report

| Syllabus and component number | | | | | / | | |
|---|---|---|---|---|---|---|---|

| Centre number | | | | | |
|---|---|---|---|---|---|

Centre name .....

Time of the practical session .....

Laboratory name/number .....

**Give details of any difficulties experienced by the centre or by candidates (include the relevant candidate names and candidate numbers).**

You must include:
- any difficulties experienced by the centre in the preparation of materials
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- any specific assistance given to candidates.

**If chemicals have been prepared in more than one batch, list the candidates using each batch.**

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4 I have reported any other adverse circumstances affecting candidates, e.g. illness, bereavement or temporary injury, directly to Cambridge International on a *special consideration form*.

Signed ..... (supervisor)

Name (in block capitals) .....

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