
CHEMISTRY

9701/31

Paper 3 Advanced Practical Skills 1

May/June 2016

CONFIDENTIAL INSTRUCTIONS

Great care should be taken to ensure that any confidential information given does not reach the candidates either directly or indirectly.

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The Supervisor's attention is drawn to the form on page 7 which must be completed and returned with the scripts.

If you have any problems or queries regarding these Instructions, please contact CIE

by e-mail: info@cie.org.uk,

by phone: +44 1223 553554,

by fax: +44 1223 553558,

stating the Centre number, the nature of the query and the syllabus number quoted above.

This document consists of **8** printed pages.



Safety

Supervisors are advised to remind candidates that **all** substances in the examination should be treated with caution.

Only those tests described in the question paper should be attempted. Please also see under 'Apparatus' on the use of pipette fillers, safety goggles and plastic gloves.

In accordance with COSHH (Control of Substances Hazardous to Health) Regulations, operative in the UK, a hazard appraisal of the examination has been carried out.

Attention is drawn in particular, to certain materials used in the examination. The following codes are used where relevant.

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

The attention of Supervisors is drawn to any local regulations relating to safety and first-aid.

'Hazard Data Sheets', relating to materials used in this examination, should be available from your chemical supplier.

Before the Examination

1 Access to the question paper is **NOT** permitted in advance of the examination.

2 Preparation of materials

Where quantities are specified for each candidate, they are sufficient for the experiments described in the question paper to be completed.

In preparing materials, the bulk quantity for each substance should be increased by 25% as spare material should be available to cover accidental loss. More material may be supplied if requested by candidates, without penalty.

All solutions should be bulked and mixed thoroughly before use to ensure uniformity.

Every effort should be made to keep the concentrations accurate to within one part in two hundred of those specified.

Supervisors are asked to carry out any confirmatory tests given on page 4 to ensure the materials supplied are appropriate.

If the concentrations differ slightly from those specified, the Examiners will make the necessary allowance. They should be informed of the exact concentrations.

3 Labelling of materials

Materials must be labelled as specified in these Instructions. Materials with an **FA** code number should be so labelled **without** the identities being included on the label. Where appropriate the identity of an **FA** coded chemical is given in the question paper itself.

4 Identity of materials

It should be noted that descriptions of materials given in the question paper may not correspond with the specifications in these Instructions. **The candidates must assume the descriptions given in the question paper.**

5 Size of group

In view of the difficulty of the preparation of large quantities of solution of uniform concentration, it is recommended that the maximum number of candidates per group be 30 and that separate supplies of solutions be prepared for each group.

Apparatus

- 1 In addition to the fittings ordinarily contained in a chemical laboratory, the apparatus and materials specified below will be necessary.
- 2 Pipette fillers (or equivalent safety devices), safety goggles and disposable gloves should be used where necessary.

3 *For each candidate*

1 × 250 cm³ beaker
1 × 100 cm³ beaker
1 × 25 cm³ measuring cylinder
1 × 250 cm³ volumetric (graduated) flask
1 × 25 cm³ pipette
1 × 50 cm³ burette
2 × 150 cm³ or 250 cm³ conical flask
1 × burette stand and clamp
1 × funnel (for filling burette)
1 × white tile
1 × tripod and gauze
1 × Bunsen burner
1 × heat-proof mat
1 × spatula
1 × thermometer (−10 °C to +110 °C at 1 °C)
1 × hard-glass test-tube
6 × test-tube*
1 × test-tube rack
1 × test-tube holder
1 × glass rod
2 × teat/dropping pipette
1 × wash bottle of distilled water
paper towels
1 × marker or labels (suitable for labelling glassware)
access to a balance weighing to at least 0.1 g

* Candidates are expected to rinse and re-use 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 examination with Question 3. See page 58 of the current syllabus for balance : candidate ratio.

Chemicals Required

- 1 It is **especially important** that great care is taken that the confidential information given below does **not** reach the candidates either directly or indirectly.
- 2 It should be noted that descriptions of materials given in the question paper may not correspond with the specifications in these Instructions.
- 3 Particular requirements

hazard	label	per candidate	identity	notes (hazards given in this column are for the raw materials)
	FA 1	2 g	calcium carbonate	1.9 - 2.1 g calcium carbonate in a stoppered container. The calcium carbonate should be from a freshly opened sample.
	FA 2	40 cm ³	2.0 mol dm ⁻³ hydrochloric acid	See preparation instructions on page 56 of the current syllabus.
	FA 3	150 cm ³	0.040 mol dm ⁻³ sodium hydroxide	Make 20.00 cm ³ of 2.0 mol dm ⁻³ NaOH [C] up to 1 dm ³ with distilled water. This must be freshly prepared as solutions absorb CO ₂ from the air. For preparation of 2.0 mol dm ⁻³ NaOH [C] see instructions on page 56 of the current syllabus.
[HH] [N]	FA 5	1.4 g	a mixture of manganese(II) sulfate and ammonium chloride	Grind together 0.7 ± 0.1 g of MnSO ₄ ·4H ₂ O [HH] [N] and 0.7 ± 0.1 g of NH ₄ Cl [HH] per candidate. Provide in a stoppered container. Note: any form of hydrated manganese sulfate is suitable.
[F] [MH]	FA 6	2 cm ³	propanone	Approximately 2 cm ³ of CH ₃ COCH ₃ [F] [MH] in a stoppered container.
[F] [MH]	FA 7	2 cm ³	propanal	Approximately 2 cm ³ of CH ₃ CH ₂ CHO [F] [MH] in a stoppered container.
	distilled water	300 cm ³	distilled water	
[F] [MH] [HH]	methyl orange indicator	5 cm ³	methyl orange	See preparation instructions on page 56 of the current syllabus.

- 4 The reagents below should also be provided. Unless otherwise stated, each candidate should require no more than 10 cm³ of any of these reagents. If necessary, they may be made available from a communal supply: however, the attention of the Invigilators should be drawn to the fact that such an arrangement may lead to contamination of reagents and enhance the opportunity for malpractice between candidates.

hazard	label	notes
	dilute hydrochloric acid	See identity details and preparation instructions on pages 56 and 57 of the current syllabus.
[C]	dilute nitric acid	
[MH]	dilute sulfuric acid	
[C][MH] [N]	aqueous ammonia	
[C]	aqueous sodium hydroxide	
	0.1 mol dm⁻³ barium chloride or 0.1 mol dm⁻³ barium nitrate	
[N]	0.05 mol dm⁻³ silver nitrate	
[MH]	limewater	
[MH]	acidified aqueous potassium manganate(VII)	

- 5 The following materials and apparatus should be available.

red and blue litmus papers, aluminium foil for testing nitrate/nitrite, wooden splints and the apparatus normally used in the Centre for use with limewater in testing for carbon dioxide

Responsibilities of the Supervisor during the Examination

- 1 The Supervisor, or other competent chemist, **must, out of sight of the candidates, carry out the experiments in Question 1 and Question 2** and complete tables of readings on a spare copy of the question paper which should be labelled 'Supervisor's Results'.

**This should be done for:
each session held and each laboratory used in that session, and each batch of solutions supplied.**

N.B. The question paper cover requests the candidate to fill in details of the examination session and the laboratory used for the examination.

It is essential that each packet of scripts contains a copy of the applicable Supervisor's Results as the candidates' work cannot be assessed accurately without such information.

- 2 The Supervisor must complete the Report Form on page 7 to show which candidates attended each session. If all candidates took the examination in one session, please indicate this on the Report Form. A copy of the Report Form must accompany each copy of the Supervisor's Results in order for the candidates' work to be assessed accurately.

The Supervisor must give details on page 8 of any particular difficulties experienced by a candidate, especially if the Examiner would be unable to discover this from the written answers.

After the Examination

Each envelope returned to Cambridge must contain the following items.

- 1 The scripts of those candidates specified on the bar code label provided.
- 2 A copy of the Supervisor's Results relevant to the candidates in 1.
- 3 A copy of the Report Form, including details of any difficulties experienced by candidates (see pages 7 and 8).
- 4 The Attendance Register.
- 5 **A Seating Plan for each session/laboratory.**

Failure to provide appropriate documentation in each envelope may cause candidates to be penalised.

COLOUR BLINDNESS

With regard to colour blindness it is permissible to advise candidates who request assistance on colours of, for example, precipitates and solutions (especially titration end-points). Please include with the scripts a note of the candidate numbers of such candidates.

Experience suggests that candidates who are red/green colour-blind – the most common form – do not generally have significant difficulty. Reporting such cases with the scripts removes the need for a 'Special Consideration' application.

REPORT FORM

This form must be completed and sent to the Examiner in the envelope with the scripts.

Centre number Name of Centre

1 Supervisor's Results

Please submit details of the readings obtained in **Question 1** and **Question 2** on a spare copy of the question paper clearly marked 'Supervisor's Results' and **showing the Centre number and appropriate session/laboratory number.**

2 The candidate numbers of candidates attending each session were:

First Session

Second Session

3 The Supervisor is required to give details overleaf of any difficulties experienced by particular candidates, giving names and candidate numbers. These should include reference to:

- (a) any general difficulties encountered in preparation of materials;
- (b) difficulties due to faulty apparatus or materials;
- (c) accidents to apparatus or materials;
- (d) assistance with respect to colour blindness.

Other cases of hardship, e.g. illness, temporary disability, should be reported direct to CIE on the normal 'Application for Special Consideration' form.

4 A plan of work benches, giving details by candidate numbers of the places occupied by the candidates for each experiment for each session, must be enclosed with the scripts.



Report on any difficulties experienced by candidates.

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CHEMISTRY

9701/32

Paper 3 Advanced Practical Skills 2

May/June 2016

CONFIDENTIAL INSTRUCTIONS

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All solutions should be bulked and mixed thoroughly before use to ensure uniformity.

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Supervisors are asked to carry out any confirmatory tests given on page 4 to ensure the materials supplied are appropriate.

If the concentrations differ slightly from those specified, the Examiners will make the necessary allowance. They should be informed of the exact concentrations.

3 Labelling of materials

Materials must be labelled as specified in these Instructions. Materials with an **FB** code number should be so labelled **without** the identities being included on the label. Where appropriate the identity of an **FB** coded chemical is given in the question paper itself.

4 Identity of materials

It should be noted that descriptions of materials given in the question paper may not correspond with the specifications in these Instructions. **The candidates must assume the descriptions given in the question paper.**

5 Size of group

In view of the difficulty of the preparation of large quantities of solution of uniform concentration, it is recommended that the maximum number of candidates per group be 30 and that separate supplies of solutions be prepared for each group.

Apparatus

- 1 In addition to the fittings ordinarily contained in a chemical laboratory, the apparatus and materials specified below will be necessary.
- 2 Pipette fillers (or equivalent safety devices), safety goggles and disposable gloves should be used where necessary.

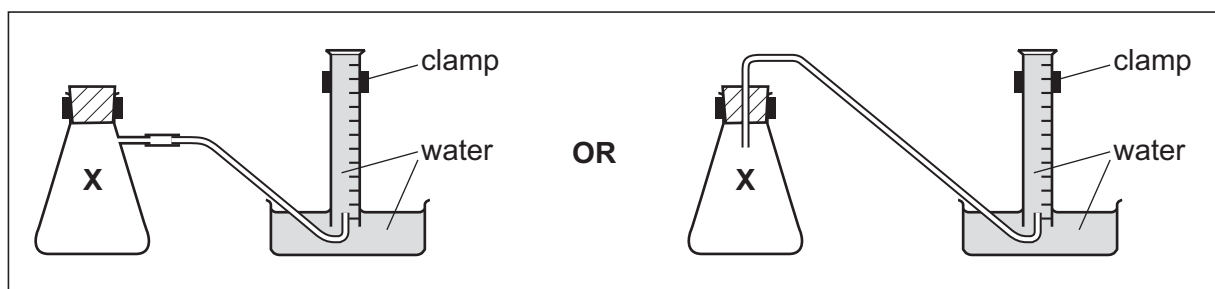
3 *For each candidate*

- 1 × 250 cm³ measuring cylinder
- 2 × stand, clamp and boss
- 1 × side-arm conical flask, labelled **X**, with bung and approximately 50 cm of plastic/rubber delivery tube to fit
- or
- 1 × 150 cm³ or 250 cm³ conical flask, labelled **X**, with one-hole bung connected to approximately 50 cm of plastic/rubber delivery tube (see below for diagrams)
- 1 × tub suitable for acting as trough (minimum capacity 1 dm³)
- 1 × 50 cm³ burette
- 1 × burette clamp
- 1 × 25 cm³ pipette
- 1 × 250 cm³ volumetric (graduated) flask
- 1 × funnel (for filling burette)
- 2 × 150 cm³ or 250 cm³ conical flask
- 1 × white tile
- 1 × glass rod
- 1 × spatula
- 8 × test-tube*
- 2 × boiling tube*
- 1 × Bunsen burner
- 1 × heat-proof mat
- 1 × test-tube rack
- 1 × test-tube holder
- 2 × teat/dropping pipette
- 1 × wash bottle of distilled water
- 1 × marker or labels (suitable for labelling glassware)
- paper towels
- access to a balance weighing to **at least** 0.1 g

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

Where the provision of balances and / or 250 cm³ measuring cylinders is limited, some candidates should be instructed to start the examination with Question 3. See page 58 of the current syllabus for balance : candidate ratio.

These diagrams are to assist technicians in selecting apparatus but the apparatus is **not** to be set up for the candidates.



Chemicals Required

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- 3 Particular requirements

hazard	label	per candidate	identity	notes (hazards given in this column are for the raw materials)
[F]	FB 1	0.20 ± 0.01 g	magnesium ribbon	Provide one 13.5 ± 0.1 cm piece of magnesium ribbon [F] in a stoppered container. All candidates to be provided with a single strip from the same batch.
[MH]	FB 2	40 cm ³	1.00 mol dm ⁻³ sulfuric acid	See preparation instructions on page 56 of the current syllabus.
[MH]	FB 3	150 cm ³	0.150 mol dm ⁻³ sodium hydroxide	Dissolve 6.0 g NaOH [C] in each dm ³ of solution.
[F]	FB 5	1.0 g	aluminium powder	Provide approximately 1.0 g aluminium powder [F] in a stoppered container. (Coarse powder is preferable.)
[O] [HH]	FB 6	1.5 g	sodium nitrate	Provide approximately 1.5 g NaNO ₃ [O][HH] in a stoppered container.
	FB 7	15 cm ³	0.10 mol dm ⁻³ aluminium sulfate	Dissolve 34.2 g Al ₂ (SO ₄) ₃ or 63.0 g Al ₂ (SO ₄) ₃ · 16H ₂ O in each dm ³ of solution.
	FB 8	15 cm ³	0.10 mol dm ⁻³ manganese(II) chloride	Dissolve 12.6 g MnCl ₂ [HH] or 19.8 g MnCl ₂ · 4H ₂ O [HH] in each dm ³ of solution.
	distilled water	250 cm ³	distilled water	
[F] [MH] [HH]	bromophenol blue	5 cm ³	bromophenol blue indicator	See preparation instructions on page 57 of the current syllabus.

NOTE: It is important that the laboratory is well ventilated as unpleasant fumes may be evolved.

- 4 The reagents below should also be provided. Unless otherwise stated, each candidate should require no more than 10 cm³ of any of these reagents. If necessary, they may be made available from a communal supply: however, the attention of the Invigilators should be drawn to the fact that such an arrangement may lead to contamination of reagents and enhance the opportunity for malpractice between candidates.

hazard	label	per candidate	notes
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[C]	dilute nitric acid		
[MH]	dilute sulfuric acid		
[C][MH] [N]	aqueous ammonia		
[C]	aqueous sodium hydroxide	15 cm ³	
	0.1 mol dm⁻³ barium chloride or 0.1 mol dm⁻³ barium nitrate		
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CHEMISTRY

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Paper 3 Advanced Practical Skills 1

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- 1 In addition to the fittings ordinarily contained in a chemical laboratory, the apparatus and materials specified below will be necessary.
- 2 Pipette fillers (or equivalent safety devices), safety goggles and disposable gloves should be used where necessary.

3 *For each candidate*

- 1 × 250 cm³ volumetric (graduated) flask
- 2 × 25 cm³ pipette
- 1 × white tile
- 1 × 50 cm³ burette
- 1 × funnel (for filling burette)
- 1 × burette clamp
- 2 × 150 cm³ or 250 cm³ conical flask
- 1 × 250 cm³ measuring cylinder
- 1 × 50 cm³ measuring cylinder
- 1 × side-arm conical flask, labelled **X**, with bung and approximately 50 cm of plastic/rubber delivery tube to fit

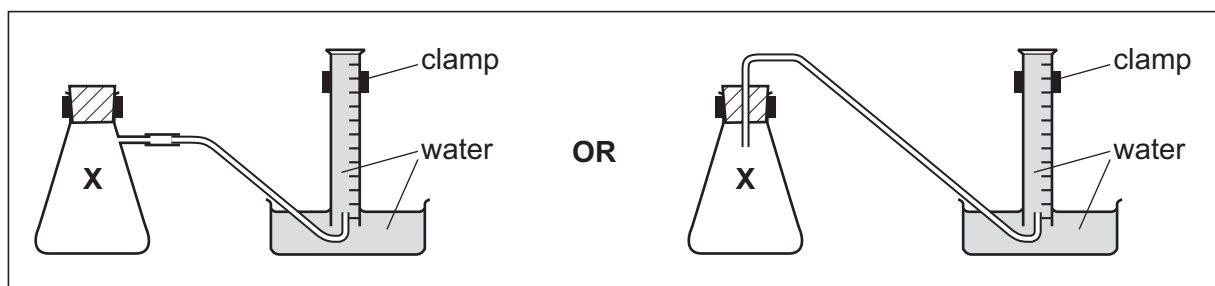
or

- 1 × 150 cm³ or 250 cm³ conical flask, labelled **X**, with one-hole bung connected to approximately 50 cm of plastic/rubber delivery tube (see below for diagrams)
- 1 × tub suitable for acting as trough (minimum capacity 1 dm³)
- 2 × stand, clamp and boss
- 1 × 250 cm³ beaker
- 1 × thermometer (−10 °C to +110 °C at 1 °C)
- 1 × Bunsen burner
- 1 × heat-proof mat
- 1 × tripod and gauze
- 1 × test-tube holder
- 8 × test-tube*
- 1 × spatula
- 2 × hard-glass test-tube
- 2 × boiling tube*
- 1 × test-tube rack
- 2 × teat/dropping pipette
- 1 × wash bottle of distilled water
- paper towels
- access to a balance weighing to **at least** 0.1 g
- 1 × marker or labels (suitable for labelling glassware)

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

Where the provision of balances or 250 cm³ measuring cylinders is limited candidates should be directed to start the examination on different questions. See page 58 of the current syllabus for balance : candidate ratio.

These diagrams are to assist technicians in selecting apparatus but the apparatus is **not** to be set up for the candidates.



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hazard	label	per candidate	identity	notes (hazards given in this column are for the raw materials)
	FA 1	150 cm ³	0.10 mol dm ⁻³ sodium hydroxide	Dissolve 4.0 g of NaOH [C] in each dm ³ of solution.
	FA 2	120 cm ³	1.0 mol dm ⁻³ hydrochloric acid	Prepare 2.0 mol dm ⁻³ HCl using preparation instructions on page 56 of the current syllabus. Dilute using an equal volume of distilled water.
[HH]	FA 4	0.90 g	anhydrous sodium carbonate	0.90 ± 0.05 g Na ₂ CO ₃ [HH] supplied in a stoppered container.
[F][MH] [HH]	bromophenol blue	5 cm ³	bromophenol blue indicator	See identity details and preparation instructions on page 57 of the current syllabus.
[MH]	FA 5	10 cm ³	1.0 mol dm ⁻³ methanoic acid	Dilute 51 cm ³ concentrated methanoic acid, HCO ₂ H, (90%) [C][F] in each dm ³ of solution.
	FA 6	10 cm ³	1.0 mol dm ⁻³ ethanoic acid	Dilute 57 cm ³ concentrated ethanoic acid, CH ₃ CO ₂ H, (17.4 mol dm ⁻³) [C][F] in each dm ³ of solution.
[F][HH] [MH]	FA 7	10 cm ³	ethanol	Supply 10 cm ³ of ethanol [F][HH][MH] in a stoppered container. IMS/IDA is suitable.
	FA 8	10 cm ³	1.0 mol dm ⁻³ glucose	Dissolve 180 g glucose, C ₆ H ₁₂ O ₆ , in each dm ³ of solution.
[O] [MH] [N]	FA 9	1 g	zinc nitrate	1 ± 0.1 g solid Zn(NO ₃) ₂ [O][MH][N] (can be hydrated or anhydrous) supplied in a stoppered container.
[O][HH]	FA 10	1 g	sodium nitrate	1 ± 0.1 g solid NaNO ₃ [O][HH] supplied in a stoppered container.

- 4 The reagents below should also be provided. Unless otherwise stated, each candidate should require no more than 10 cm³ of any of these reagents. If necessary, they may be made available from a communal supply: however, the attention of the Invigilators should be drawn to the fact that such an arrangement may lead to contamination of reagents and enhance the opportunity for malpractice between candidates.

hazard	label	per candidate	identity	notes
	dilute hydrochloric acid			
[C]	dilute nitric acid			
[MH]	dilute sulfuric acid			
[C][MH] [N]	aqueous ammonia			
[C]	aqueous sodium hydroxide			
	0.1 mol dm⁻³ barium chloride or 0.1 mol dm⁻³ barium nitrate			
[N]	0.05 mol dm⁻³ silver nitrate			
[MH]	limewater			
[MH]	acidified aqueous potassium manganate(VII)			
[HH]	sodium carbonate	2 g	anhydrous Na ₂ CO ₃	

See identity details and preparation instructions on pages 56 and 57 of the current syllabus.

- 5 The following materials and apparatus should be available.

red and blue litmus papers, aluminium foil for testing nitrate/nitrite, wooden splints and the apparatus normally used in the Centre for use with limewater in testing for carbon dioxide

Responsibilities of the Supervisor during the Examination

- 1 The Supervisor, or other competent chemist, **must, out of sight of the candidates, carry out the experiments in Question 1 and Question 2** and complete tables of readings on a spare copy of the question paper which should be labelled 'Supervisor's Results'.

**This should be done for:
each session held and each laboratory used in that session, and each batch of solutions supplied.**

N.B. The question paper cover requests the candidate to fill in details of the examination session and the laboratory used for the examination.

It is essential that each packet of scripts contains a copy of the applicable Supervisor's Results as the candidates' work cannot be assessed accurately without such information.

- 2 The Supervisor must complete the Report Form on page 7 to show which candidates attended each session. If all candidates took the examination in one session, please indicate this on the Report Form. A copy of the Report Form must accompany each copy of the Supervisor's Results in order for the candidates' work to be assessed accurately.

The Supervisor must give details on page 8 of any particular difficulties experienced by a candidate, especially if the Examiner would be unable to discover this from the written answers.

After the Examination

Each envelope returned to Cambridge must contain the following items.

- 1 The scripts of those candidates specified on the bar code label provided.
- 2 A copy of the Supervisor's Results relevant to the candidates in 1.
- 3 A copy of the Report Form, including details of any difficulties experienced by candidates (see pages 7 and 8).
- 4 The Attendance Register.
- 5 **A Seating Plan for each session/laboratory.**

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COLOUR BLINDNESS

With regard to colour blindness it is permissible to advise candidates who request assistance on colours of, for example, precipitates and solutions (especially titration end-points). Please include with the scripts a note of the candidate numbers of such candidates.

Experience suggests that candidates who are red/green colour-blind – the most common form – do not generally have significant difficulty. Reporting such cases with the scripts removes the need for a 'Special Consideration' application.

REPORT FORM

This form must be completed and sent to the Examiner in the envelope with the scripts.

Centre number Name of Centre

1 Supervisor's Results

Please submit details of the readings obtained in **Question 1** and **Question 2** on a spare copy of the question paper clearly marked 'Supervisor's Results' and **showing the Centre number and appropriate session/laboratory number.**

2 The candidate numbers of candidates attending each session were:

First Session

Second Session

3 The Supervisor is required to give details overleaf of any difficulties experienced by particular candidates, giving names and candidate numbers. These should include reference to:

- (a) any general difficulties encountered in preparation of materials;
- (b) difficulties due to faulty apparatus or materials;
- (c) accidents to apparatus or materials;
- (d) assistance with respect to colour blindness.

Other cases of hardship, e.g. illness, temporary disability, should be reported direct to CIE on the normal 'Application for Special Consideration' form.

4 A plan of work benches, giving details by candidate numbers of the places occupied by the candidates for each experiment for each session, must be enclosed with the scripts.



Report on any difficulties experienced by candidates.

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CHEMISTRY

9701/34

Paper 3 Advanced Practical Skills 2

May/June 2016

CONFIDENTIAL INSTRUCTIONS

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by e-mail: info@cie.org.uk,

by phone: +44 1223 553554,

by fax: +44 1223 553558,

stating the Centre number, the nature of the query and the syllabus number quoted above.

This document consists of **8** printed pages.



Safety

Supervisors are advised to remind candidates that **all** substances in the examination should be treated with caution.

Only those tests described in the question paper should be attempted. Please also see under 'Apparatus' on the use of pipette fillers, safety goggles and plastic gloves.

In accordance with COSHH (Control of Substances Hazardous to Health) Regulations, operative in the UK, a hazard appraisal of the examination has been carried out.

Attention is drawn in particular, to certain materials used in the examination. The following codes are used where relevant.

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

The attention of Supervisors is drawn to any local regulations relating to safety and first-aid.

'Hazard Data Sheets', relating to materials used in this examination, should be available from your chemical supplier.

Before the Examination

1 Access to the question paper is NOT permitted in advance of the examination.

2 Preparation of materials

Where quantities are specified for each candidate, they are sufficient for the experiments described in the question paper to be completed.

In preparing materials, the bulk quantity for each substance should be increased by 25% as spare material should be available to cover accidental loss. More material may be supplied if requested by candidates, without penalty.

All solutions should be bulked and mixed thoroughly before use to ensure uniformity.

Every effort should be made to keep the concentrations accurate to within one part in two hundred of those specified.

Supervisors are asked to carry out any confirmatory tests given on page 4 to ensure the materials supplied are appropriate.

If the concentrations differ slightly from those specified, the Examiners will make the necessary allowance. They should be informed of the exact concentrations.

3 Labelling of materials

Materials must be labelled as specified in these Instructions. Materials with an **FB** code number should be so labelled **without** the identities being included on the label. Where appropriate the identity of an **FB** coded chemical is given in the question paper itself.

4 Identity of materials

It should be noted that descriptions of materials given in the question paper may not correspond with the specifications in these Instructions. **The candidates must assume the descriptions given in the question paper.**

5 Size of group

In view of the difficulty of the preparation of large quantities of solution of uniform concentration, it is recommended that the maximum number of candidates per group be 30 and that separate supplies of solutions be prepared for each group.

Apparatus

- 1 In addition to the fittings ordinarily contained in a chemical laboratory, the apparatus and materials specified below will be necessary.
- 2 Pipette fillers (or equivalent safety devices), safety goggles and disposable gloves should be used where necessary.

3 *For each candidate*

1 × 10 cm³ pipette
1 × 25 cm³ pipette
1 × 50 cm³ burette
2 × 150 cm³ or 250 cm³ conical flask
1 × 250 cm³ volumetric (graduated) flask
1 × burette stand and clamp
1 × funnel (for filling burette)
1 × white tile
1 × spatula
2 × teat/dropping pipette
1 × crucible with lid, capacity approximately 15 cm³
1 × crucible tongs
1 × heat-proof mat
1 × tripod
1 × Bunsen burner
1 × pipe-clay triangle
1 × stop clock or sight of a clock with seconds display
1 × hard-glass test-tube
8 × test-tube*
1 × test-tube rack
1 × test-tube holder
1 × wash bottle containing distilled water
1 × marker or labels (suitable for labelling glassware)
paper towels
access to a balance weighing to **at least** 0.1 g

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

Where the provision of balances is limited, some candidates should be instructed to start the examination with Question 2. See page 58 of the current syllabus for balance : candidate ratio.

Chemicals Required

- 1 It is **especially important** that great care is taken that the confidential information given below does **not** reach the candidates either directly or indirectly.
- 2 It should be noted that descriptions of materials given in the question paper may not correspond with the specifications in these Instructions.
- 3 Particular requirements

hazard	label	per candidate	identity	notes (hazards given in this column are for the raw materials)
	FB 1	150 cm ³	0.0406 mol dm ⁻³ hydrated 'borax', disodium tetraborate	Dissolve 15.5 g of hydrated 'borax', Na ₂ B ₄ O ₇ · 10H ₂ O [HH] in each dm ³ of solution. The solid should be ground to a fine powder. The solution should be warmed and stirred to aid dissolving.
	FB 2	30 cm ³	2.00 mol dm ⁻³ hydrochloric acid	See preparation instructions on page 56 of the current syllabus.
	FB 4	1.5 g	basic magnesium carbonate	1.5 - 1.6 g of 3MgCO ₃ · Mg(OH) ₂ · 3H ₂ O in a stoppered container. Any type of basic magnesium carbonate is suitable, irrespective of the formula on the container.
	FB 5	10 cm ³	0.2 mol dm ⁻³ barium chloride	Dissolve 48.8 g BaCl ₂ · 2H ₂ O [T] in each dm ³ of solution. (Barium nitrate is not a suitable alternative.)
[N]	FB 6	10 cm ³	0.05 mol dm ⁻³ silver nitrate	See preparation instructions on page 56 of the current syllabus.
[MH]	FB 7	10 cm ³	1.0 mol dm ⁻³ sulfuric acid	See preparation instructions on page 56 of the current syllabus.
	FB 8	2 g	sodium hydrogencarbonate	Approximately 2 g of NaHCO ₃ in a stoppered container.
[F]	magnesium ribbon	3 × 2 cm strips	magnesium ribbon	Strips of Mg ribbon [F] cut to approximate length 2 cm. Ensure that extra strips are available.
	aqueous potassium iodide	10 cm ³	0.2 mol dm ⁻³ potassium iodide	Dissolve 33.2 g of KI in each dm ³ of solution.
	distilled water	350 cm ³	distilled water	
[F][MH][HH]	methyl orange indicator	5 cm ³	methyl orange indicator	See preparation instructions on page 56 of the current syllabus.

- 4 The reagents below should also be provided. Unless otherwise stated, each candidate should require no more than 10 cm³ of any of these reagents. If necessary, they may be made available from a communal supply: however, the attention of the Invigilators should be drawn to the fact that such an arrangement may lead to contamination of reagents and enhance the opportunity for malpractice between candidates.

hazard	label	notes
	dilute hydrochloric acid	See identity details and preparation instructions on pages 56 and 57 of the current syllabus.
[C]	dilute nitric acid	
[MH]	dilute sulfuric acid	
[C][MH] [N]	aqueous ammonia	
[C]	aqueous sodium hydroxide	
	0.1 mol dm⁻³ barium chloride or 0.1 mol dm⁻³ barium nitrate	
[N]	0.05 mol dm⁻³ silver nitrate	
[MH]	limewater	
[MH]	aqueous acidified potassium manganate(VII)	

- 5 The following materials and apparatus should be available.

red and blue litmus papers, aluminium foil for testing nitrate/nitrite, wooden splints and the apparatus normally used in the Centre for use with limewater in testing for carbon dioxide

Responsibilities of the Supervisor during the Examination

- 1 The Supervisor, or other competent chemist, **must, out of sight of the candidates, carry out the experiments in Question 1 and Question 2** and complete tables of readings on a spare copy of the question paper which should be labelled 'Supervisor's Results'.

**This should be done for:
each session held and each laboratory used in that session, and each batch of solutions supplied.**

N.B. The question paper cover requests the candidate to fill in details of the examination session and the laboratory used for the examination.

It is essential that each packet of scripts contains a copy of the applicable Supervisor's Results as the candidates' work cannot be assessed accurately without such information.

- 2 The Supervisor must complete the Report Form on page 7 to show which candidates attended each session. If all candidates took the examination in one session, please indicate this on the Report Form. A copy of the Report Form must accompany each copy of the Supervisor's Results in order for the candidates' work to be assessed accurately.

The Supervisor must give details on page 8 of any particular difficulties experienced by a candidate, especially if the Examiner would be unable to discover this from the written answers.

After the Examination

Each envelope returned to Cambridge must contain the following items.

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COLOUR BLINDNESS

With regard to colour blindness it is permissible to advise candidates who request assistance on colours of, for example, precipitates and solutions (especially titration end-points). Please include with the scripts a note of the candidate numbers of such candidates.

Experience suggests that candidates who are red/green colour-blind – the most common form – do not generally have significant difficulty. Reporting such cases with the scripts removes the need for a 'Special Consideration' application.

REPORT FORM

This form must be completed and sent to the Examiner in the envelope with the scripts.

Centre number Name of Centre

1 Supervisor's Results

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First Session

Second Session

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- (c) accidents to apparatus or materials;
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CHEMISTRY

9701/35

Paper 3 Advanced Practical Skills 1

May/June 2016

CONFIDENTIAL INSTRUCTIONS

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* 2 1 8 5 2 8 0 1 9 0 *



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by e-mail: info@cie.org.uk,

by phone: +44 1223 553554,

by fax: +44 1223 553558,

stating the Centre number, the nature of the query and the syllabus number quoted above.

This document consists of **8** printed pages.



Safety

Supervisors are advised to remind candidates that **all** substances in the examination should be treated with caution.

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In accordance with COSHH (Control of Substances Hazardous to Health) Regulations, operative in the UK, a hazard appraisal of the examination has been carried out.

Attention is drawn in particular, to certain materials used in the examination. The following codes are used where relevant.

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

The attention of Supervisors is drawn to any local regulations relating to safety and first-aid.

'Hazard Data Sheets', relating to materials used in this examination, should be available from your chemical supplier.

Before the Examination

1 Access to the question paper is NOT permitted in advance of the examination.

2 Preparation of materials

Where quantities are specified for each candidate, they are sufficient for the experiments described in the question paper to be completed.

In preparing materials, the bulk quantity for each substance should be increased by 25% as spare material should be available to cover accidental loss. More material may be supplied if requested by candidates, without penalty.

All solutions should be bulked and mixed thoroughly before use to ensure uniformity.

Every effort should be made to keep the concentrations accurate to within one part in two hundred of those specified.

Supervisors are asked to carry out any confirmatory tests given on page 4 to ensure the materials supplied are appropriate.

If the concentrations differ slightly from those specified, the Examiners will make the necessary allowance. They should be informed of the exact concentrations.

3 Labelling of materials

Materials must be labelled as specified in these Instructions. Materials with an **FA** code number should be so labelled **without** the identities being included on the label. Where appropriate the identity of an **FA** coded chemical is given in the question paper itself.

4 Identity of materials

It should be noted that descriptions of materials given in the question paper may not correspond with the specifications in these Instructions. **The candidates must assume the descriptions given in the question paper.**

5 Size of group

In view of the difficulty of the preparation of large quantities of solution of uniform concentration, it is recommended that the maximum number of candidates per group be 30 and that separate supplies of solutions be prepared for each group.

Apparatus

- 1 In addition to the fittings ordinarily contained in a chemical laboratory, the apparatus and materials specified below will be necessary.
- 2 Pipette fillers (or equivalent safety devices), safety goggles and disposable gloves should be used where necessary.

3 *For each candidate*

1 × 25 cm³ pipette
1 × 10 cm³ pipette
1 × 50 cm³ burette
2 × 150 cm³ or 250 cm³ conical flask
1 × 250 cm³ volumetric (graduated) flask
1 × 250 cm³ beaker
1 × 100 cm³ beaker
1 × burette stand and clamp
1 × funnel (for filling burette)
1 × white tile
1 × 50 cm³ measuring cylinder
1 × spatula
2 × teat/dropping pipette
1 × glass rod
1 × foamed plastic (polystyrene) cup
1 × thermometer (−10 °C to +110 °C at 1 °C)
1 × heat-proof mat
1 × Bunsen burner
1 × tripod
1 × gauze
2 × boiling tube*
6 × test-tube*
1 × hard-glass test-tube
1 × test-tube rack
1 × test-tube holder
1 × wash bottle containing distilled water
1 × marker or labels (suitable for labelling glassware)
paper towels

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

Chemicals Required

- 1 It is **especially important** that great care is taken that the confidential information given below does **not** reach the candidates either directly or indirectly.
- 2 It should be noted that descriptions of materials given in the question paper may not correspond with the specifications in these Instructions.
- 3 Particular requirements

hazard	label	per candidate	identity	notes (hazards given in this column are for the raw materials)
[MH]	FA 1	100 cm ³	1.20 mol dm ⁻³ sulfuric acid	Cautiously pour 66 cm ³ of concentrated (98%) sulfuric acid [C] into 500 cm ³ of distilled water with continuous stirring. Make the solution up to 1.00 dm ³ with distilled water. Care: concentrated H ₂ SO ₄ is very corrosive.
	FA 2	150 cm ³	0.105 mol dm ⁻³ sodium hydroxide	Dissolve 4.20 g of NaOH [C] in each dm ³ of solution.
	FA 4	3.0 g	magnesium carbonate	3.0 - 3.1 g of magnesium carbonate 3MgCO ₃ ·Mg(OH) ₂ ·3H ₂ O in a stoppered container. Any form of 'basic' magnesium carbonate is suitable.
	FA 5	1.5 g	magnesium oxide	1.5 - 1.6 g of magnesium oxide, MgO in a stoppered container.
[O]	FA 6	2 g	magnesium nitrate	Approximately 2 g of hydrated magnesium nitrate, Mg(NO ₃) ₂ ·6H ₂ O [O], in a stoppered container. Any form of hydrated magnesium nitrate is suitable. The sample supplied to candidates must be solid.
[MH] [N]	FA 7	20 cm ³	0.1 mol dm ⁻³ zinc sulfate and 0.2 mol dm ⁻³ potassium iodide	Dissolve a mixture of 28.7 g of hydrated zinc sulfate, ZnSO ₄ ·7H ₂ O [C] [MH][N] and 33.2 g of potassium iodide, KI in each dm ³ of solution.
	distilled water	300 cm ³	distilled water	
[F][MH] [HH]	thymolphthalein indicator	10 cm ³	thymolphthalein	See preparation instructions on page 57 of the current syllabus.
	aqueous starch	5 cm ³	starch indicator	See preparation instructions on page 56 of the current syllabus.

NOTE: It is important that the laboratory is well ventilated as unpleasant fumes may be evolved.

- 4 The reagents below should also be provided. Unless otherwise stated, each candidate should require no more than 10 cm³ of any of these reagents. If necessary, they may be made available from a communal supply: however, the attention of the Invigilators should be drawn to the fact that such an arrangement may lead to contamination of reagents and enhance the opportunity for malpractice between candidates.

hazard	label	notes
	dilute hydrochloric acid	See identity details and preparation instructions on pages 56 and 57 of the current syllabus.
[C]	dilute nitric acid	
[MH]	dilute sulfuric acid	
[C][MH] [N]	aqueous ammonia	
[C]	aqueous sodium hydroxide	
	0.1 mol dm⁻³ barium chloride or 0.1 mol dm⁻³ barium nitrate	
[MH]	limewater	
[N]	0.05 mol dm⁻³ silver nitrate	
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- 5 The following materials and apparatus should be available.

red and blue litmus papers, aluminium foil for testing nitrate/nitrite, wooden splints and the apparatus normally used in the Centre for use with limewater in testing for carbon dioxide

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- 1 The Supervisor, or other competent chemist, **must, out of sight of the candidates, carry out the experiments in Question 1 and Question 2** and complete tables of readings on a spare copy of the question paper which should be labelled 'Supervisor's Results'.

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Centre number Name of Centre

1 Supervisor's Results

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Second Session

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- (a) any general difficulties encountered in preparation of materials;
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- (c) accidents to apparatus or materials;
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