
CHEMISTRY

9701/31

Paper 3 Advanced Practical Skills 1

October/November 2015

CONFIDENTIAL INSTRUCTIONS

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

* 3 2 1 1 0 2 5 5 9 3 *

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 substance	F	highly flammable substance
H	harmful or irritating substance	O	oxidising substance
T	toxic substance	N	dangerous for the 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 solutions given in the question paper may not correspond exactly 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 × 50 cm³ burette
1 × burette stand and clamp
2 × 150 or 250 cm³ conical flask
1 × 100 cm³ beaker
1 × funnel (for filling burette)
1 × white tile
1 × 25 cm³ measuring cylinder
1 × 50 cm³ measuring cylinder
2 × teat/dropping pipette
1 × spatula
1 × heat proof mat
1 × Bunsen burner
1 × glass rod
2 × boiling tube*
8 × test-tube*
1 × test-tube holder
1 × test-tube rack
1 × wash bottle containing distilled water
1 × marker pen or labels (suitable for labelling glassware)
1 × stop watch or sight of clock reading to 1 second
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 Particular requirements

hazard	label	per candidate	identity	notes (hazards given in this column are for the raw materials)
	FA 1	120 cm ³	0.0180 mol dm ⁻³ potassium manganate(VII)	Dissolve 2.84 g of KMnO ₄ [N] [O] [H] in each dm ³ of solution.
[H]	FA 2	120 cm ³	1.00 mol dm ⁻³ sulfuric acid	See preparation instructions on page 63 of the 2015 syllabus.
	FA 3	120 cm ³	0.50 mol dm ⁻³ potassium iodide	Dissolve 83.0 g of KI in each dm ³ of solution.
	FA 4	250 cm ³	0.100 mol dm ⁻³ sodium thiosulfate	Dissolve 24.8 g of Na ₂ S ₂ O ₃ ·5H ₂ O in each dm ³ of solution.
	starch	5 cm ³	starch	See preparation instructions on page 64 of the 2015 syllabus.
	FA 5	100 cm ³	0.20 mol dm ⁻³ hydrochloric acid	Dilute 17 cm ³ of concentrated (35–37%; approximately 11 mol dm ⁻³) hydrochloric acid [C] to 1 dm ³ .
[H]	FA 6	2 g	sodium sulfite	Approximately 2 g of freshly purchased Na ₂ SO ₃ [H] in a stoppered container.
	FA 7	10 cm ³	0.5 mol dm ⁻³ calcium chloride	Dissolve 55.5 g of CaCl ₂ [H] in each dm ³ of solution. (Hydrated calcium chloride may be used.)
	FA 8	10 cm ³	0.5 mol dm ⁻³ magnesium sulfate	Dissolve 123.2 g of MgSO ₄ ·7H ₂ O in each dm ³ of solution.
	FA 9	10 cm ³	0.2 mol dm ⁻³ aluminium sulfate	Dissolve 126 g of Al ₂ (SO ₄) ₃ ·16H ₂ O in each dm ³ of solution.
	FA 10	10 cm ³	0.2 mol dm ⁻³ manganese sulfate	Dissolve 55.4 g of MnSO ₄ ·7H ₂ O [H] [N] in each dm ³ of solution. (MnSO ₄ ·H ₂ O [H] [N] is suitable.)
[H]	hydrogen peroxide	10 cm ³	'20 vol' hydrogen peroxide	Dilute 200 cm ³ of '100 vol' H ₂ O ₂ [H] to 1 dm ³ .
	distilled water	100 cm ³	distilled water	

NOTE: In the course of the examination, unpleasant fumes may be released. As a consequence, the laboratory should be well-ventilated.

- 3 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
[H]	dilute hydrochloric acid		See identity details and preparation instructions on page 63 and 64 of the 2015 syllabus.
[C]	dilute nitric acid		
[H]	dilute sulfuric acid		
	aqueous ammonia	30 cm ³	
[C]	aqueous sodium hydroxide	30 cm ³	
[H]	0.1 mol dm ⁻³ barium chloride or 0.1 mol dm ⁻³ barium nitrate		
	0.05 mol dm ⁻³ silver nitrate		
[H]	limewater		
[H]	acidified aqueous potassium manganate(VII)		

- 4 The following materials and apparatus should be available.

red and blue litmus papers, plain filter paper strips for use with acidified manganate(VII), 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 making preparation;
- (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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Apparatus

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3 *For each candidate*

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 1 × 25 cm³ pipette
 1 × 25 cm³ measuring cylinder
 1 × 50 cm³ burette
 1 × burette stand and clamp
 1 × funnel (for filling burette)
 1 × white tile
 1 × crucible (approximately 15 cm³ capacity) **without** lid
 1 × pipe-clay triangle to fit crucible
 1 × glass rod
 1 × stop clock, or sight of a clock reading to 1 second
 1 × spatula
 1 × crucible tongs
 1 × Bunsen burner
 1 × heat proof mat
 1 × tripod
 8 × test-tube*
 3 × boiling tube
 1 × stopper/bung to fit a boiling tube
 1 × filter funnel
 1 × test-tube rack
 2 × teat/dropping pipette
 1 × wash bottle containing distilled water
 filter paper
 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 tubes should be available.

Where balance provision is limited, some candidates should be instructed to start the examination with Question 2. See page 60 of the 2015 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 Particular requirements

hazard	label	per candidate	identity	notes (hazards given in this column are for the raw materials)
	FA 1	130 cm ³	0.105 mol dm ⁻³ copper(II) sulfate	Dissolve 26.20 g of CuSO ₄ .5H ₂ O [H] [N] in each dm ³ of solution.
	FA 2	150 cm ³	0.100 mol dm ⁻³ sodium thiosulfate	Dissolve 24.82 g of Na ₂ S ₂ O ₃ .5H ₂ O in each dm ³ of solution.
	FA 3	75 cm ³	0.50 mol dm ⁻³ potassium iodide	Dissolve 83.0 g KI in each dm ³ of solution.
	starch indicator	10 cm ³	starch indicator	See preparation instructions on page 64 of the 2015 syllabus.
[T]	FA 4	5 g	barium chloride dihydrate	5 g ±0.1 g BaCl ₂ .2H ₂ O [T] Should be provided in a stoppered container.
	FA 5	10 cm ³	1 mol dm ⁻³ sodium carbonate	Dissolve 106.0 g Na ₂ CO ₃ [H] or 286.0 g Na ₂ CO ₃ .10H ₂ O [H] in each dm ³ of solution.
[H]	FA 6	10 cm ³	1 mol dm ⁻³ sulfuric acid	See preparation instructions on page 63 of the 2015 syllabus.
	FA 7	10 cm ³	1 mol dm ⁻³ ethanoic acid	Dilute 57.0 cm ³ concentrated (glacial) CH ₃ COOH [C] in each dm ³ of solution.
[H] [N]	FA 8	1 g	mixture 50% (by mass) manganese(II) sulfate and 50% (by mass) magnesium carbonate.	1 g ±0.1 g mixture 50% (by mass) MnSO ₄ .H ₂ O [H] [N] and 50% (by mass) MgCO ₃ . Should be provided in a stoppered container and well mixed to ensure homogeneity.
	aqueous sodium carbonate	5 cm ³	1 mol dm ⁻³ sodium carbonate	Dissolve 106.0 g Na ₂ CO ₃ [H] or 286.0 g Na ₂ CO ₃ .10H ₂ O [H] in each dm ³ of solution. This can be prepared at the same time as FA 5 .
	aqueous copper(II) sulfate	5 cm ³	0.1 mol dm ⁻³ copper(II) sulfate	Dissolve 25.0 g CuSO ₄ .5H ₂ O [H] [N] in each dm ³ of solution.
	aqueous hydrogen peroxide	5 cm ³	5 vol hydrogen peroxide	Dilute 50 cm ³ 100 vol H ₂ O ₂ [H] in each dm ³ of solution.

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hazard	label	notes
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[C]	dilute nitric acid	
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	aqueous ammonia	
[C]	aqueous sodium hydroxide	
[H]	0.1 mol dm ⁻³ barium chloride or 0.1 mol dm ⁻³ barium nitrate	
	0.05 mol dm ⁻³ silver nitrate	
[H]	limewater	
[H]	acidified aqueous potassium manganate(VII)	

- 4 The following materials and apparatus should be available.

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CHEMISTRY

9701/34

Paper 3 Advanced Practical Skills 2

October/November 2015

CONFIDENTIAL INSTRUCTIONS

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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 solutions given in the question paper may not correspond exactly with the specifications in these Instructions. **The candidates must assume the descriptions given in the question paper.**

5 Size of group

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Apparatus

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- 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 × 50 cm³ burette
- 1 × burette stand and clamp
- 2 × 150 or 250 cm³ conical flask
- 1 × 250 cm³ volumetric (graduated) flask
- 1 × 250 cm³ beaker
- 1 × funnel (for filling burette)
- 1 × white tile
- 1 × 25 cm³ measuring cylinder
- 1 × spatula
- 2 × teat/dropping pipette
- 1 × heat proof mat
- 1 × tripod
- 1 × pipe-clay triangle
- 1 × crucible (approximately 15 cm³ capacity), with lid
- 1 × crucible tongs
- 1 × Bunsen burner
- 1 × glass rod
- 2 × boiling tube*
- 5 × test-tube*
- 1 × hard-glass test-tube
- 1 × test-tube holder
- 1 × test-tube rack
- 1 × wash bottle containing distilled water
- 1 × marker pen or labels (suitable for labelling glassware)
- 1 × stop watch, or sight of a clock reading to 1 second
- 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 tubes should be available.

Where balance provision is limited, some candidates should be instructed to start the examination with Question 2 or part of Question 3. See page 60 of the 2015 syllabus for balance : candidate ratio.

Chemicals Required

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2 Particular requirements

hazard	label	per candidate	identity	notes (hazards given in this column are for the raw materials)
[H]	FB 1	40 cm ³	2.00 mol dm ⁻³ hydrochloric acid	See preparation instructions on page 63 of the 2015 syllabus.
[F]	magnesium ribbon	0.20 g (in one strip)	magnesium ribbon	One strip of Mg ribbon [F] , lightly cleaned with emery paper or sand paper if appropriate, of mass 0.20 g. All Mg strips supplied to candidates must be cut to the same length, to within 0.2 cm, using scissors and a ruler.
	bromophenol blue	5 cm ³	bromophenol blue	See preparation instructions on page 64 of the 2015 syllabus.
[H]	FB 3	150 cm ³	0.120 mol dm ⁻³ sodium hydroxide	Dissolve 4.80 g of NaOH [C] in each dm ³ of solution.
	FB 4	2.5 g	hydrated magnesium sulfate	Approximately 2.5 g of MgSO ₄ ·7H ₂ O should be supplied in a stoppered tube.
	FB 5	20 cm ³	0.5 mol dm ⁻³ magnesium chloride	Dissolve 102 g of MgCl ₂ ·6H ₂ O in each dm ³ of solution.
[H] [O]	FB 6	2.0 g	hydrated zinc nitrate	Approximately 2.0 g Zn(NO ₃) ₂ ·xH ₂ O [H] [O] should be supplied in a stoppered tube. (The exact chemical formula of the hydrated solid is not important. The sample supplied should be solid.)
	distilled water	300 cm ³	distilled water	

NOTE: In the course of the examination, unpleasant fumes may be released. As a consequence, the laboratory should be well-ventilated.

- 3 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
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[C]	dilute nitric acid	
[H]	dilute sulfuric acid	
	aqueous ammonia	
[C]	aqueous sodium hydroxide	
[H]	0.1 mol dm ⁻³ barium chloride or 0.1 mol dm ⁻³ barium nitrate	
	0.05 mol dm ⁻³ silver nitrate	
[H]	limewater	
[H]	acidified aqueous potassium manganate(VII)	

- 4 The following materials and apparatus should be available.

red and blue litmus papers, plain filter paper strips for use with acidified manganate(VII), 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'.

**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 making preparation;
- (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

9701/35

Paper 3 Advanced Practical Skills 1

October/November 2015

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 substance	F	highly flammable substance
H	harmful or irritating substance	O	oxidising substance
T	toxic substance	N	dangerous for the 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 solutions given in the question paper may not correspond exactly 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 × 50 cm³ burette
1 × burette stand and clamp
2 × 150 or 250 cm³ conical flask
1 × 100 cm³ beaker
1 × funnel (for filling burette)
1 × white tile
1 × 25 cm³ measuring cylinder
1 × 50 cm³ measuring cylinder
2 × teat/dropping pipette
1 × spatula
1 × heat proof mat
1 × Bunsen burner
1 × glass rod
2 × boiling tube*
8 × test-tube*
1 × test-tube holder
1 × test-tube rack
1 × wash bottle containing distilled water
1 × marker pen or labels (suitable for labelling glassware)
1 × stop watch or sight of clock reading to 1 second
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 Particular requirements

hazard	label	per candidate	identity	notes (hazards given in this column are for the raw materials)
	FA 1	120 cm ³	0.0180 mol dm ⁻³ potassium manganate(VII)	Dissolve 2.84 g of KMnO ₄ [N] [O] [H] in each dm ³ of solution.
[H]	FA 2	120 cm ³	1.00 mol dm ⁻³ sulfuric acid	See preparation instructions on page 63 of the 2015 syllabus.
	FA 3	120 cm ³	0.50 mol dm ⁻³ potassium iodide	Dissolve 83.0 g of KI in each dm ³ of solution.
	FA 4	250 cm ³	0.100 mol dm ⁻³ sodium thiosulfate	Dissolve 24.8 g of Na ₂ S ₂ O ₃ ·5H ₂ O in each dm ³ of solution.
	starch	5 cm ³	starch	See preparation instructions on page 64 of the 2015 syllabus.
	FA 5	100 cm ³	0.20 mol dm ⁻³ hydrochloric acid	Dilute 17 cm ³ of concentrated (35–37%; approximately 11 mol dm ⁻³) hydrochloric acid [C] to 1 dm ³ .
[H]	FA 6	2 g	sodium sulfite	Approximately 2 g of freshly purchased Na ₂ SO ₃ [H] in a stoppered container.
	FA 7	10 cm ³	0.5 mol dm ⁻³ calcium chloride	Dissolve 55.5 g of CaCl ₂ [H] in each dm ³ of solution. (Hydrated calcium chloride may be used.)
	FA 8	10 cm ³	0.5 mol dm ⁻³ magnesium sulfate	Dissolve 123.2 g of MgSO ₄ ·7H ₂ O in each dm ³ of solution.
	FA 9	10 cm ³	0.2 mol dm ⁻³ aluminium sulfate	Dissolve 126 g of Al ₂ (SO ₄) ₃ ·16H ₂ O in each dm ³ of solution.
	FA 10	10 cm ³	0.2 mol dm ⁻³ manganese sulfate	Dissolve 55.4 g of MnSO ₄ ·7H ₂ O [H] [N] in each dm ³ of solution. (MnSO ₄ ·H ₂ O [H] [N] is suitable.)
[H]	hydrogen peroxide	10 cm ³	‘20 vol’ hydrogen peroxide	Dilute 200 cm ³ of ‘100 vol’ H ₂ O ₂ [H] to 1 dm ³ .
	distilled water	100 cm ³	distilled water	

NOTE: In the course of the examination, unpleasant fumes may be released. As a consequence, the laboratory should be well-ventilated.

- 3 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
[H]	dilute hydrochloric acid		See identity details and preparation instructions on page 63 and 64 of the 2015 syllabus.
[C]	dilute nitric acid		
[H]	dilute sulfuric acid		
	aqueous ammonia	30 cm ³	
[C]	aqueous sodium hydroxide	30 cm ³	
[H]	0.1 mol dm ⁻³ barium chloride or 0.1 mol dm ⁻³ barium nitrate		
	0.05 mol dm ⁻³ silver nitrate		
[H]	limewater		
[H]	acidified aqueous potassium manganate(VII)		

- 4 The following materials and apparatus should be available.

red and blue litmus papers, plain filter paper strips for use with acidified manganate(VII), 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.

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- 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.

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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.
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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 making preparation;
- (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.

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Report on any difficulties experienced by candidates.

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CHEMISTRY

9701/36

Paper 3 Advanced Practical Skills 2

October/November 2015

CONFIDENTIAL INSTRUCTIONS

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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 substance	F	highly flammable substance
H	harmful or irritating substance	O	oxidising substance
T	toxic substance	N	dangerous for the 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 solutions given in the question paper may not correspond exactly 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
- 2 × 100 cm³ beaker
- 1 × 25 cm³ measuring cylinder
- 1 × thermometer (−10° to +110 °C at 1 °C)
- 2 × 50 cm³ burette
- 2 × burette stand and clamp
- 1 × funnel (for filling burette)
- 1 × white tile
- 1 × glass rod
- 1 × tripod
- 1 × gauze
- 1 × Bunsen burner
- 1 × heat proof mat
- 1 × test-tube holder
- 1 × spatula
- 8 × test-tube*
- 3 × boiling tube
- 1 × test-tube rack
- 2 × teat/dropping pipette
- 1 × wash bottle containing distilled water
- paper towels
- 1 × stop watch/sight of clock reading to 1 second

*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 Particular requirements

hazard	label	per candidate	identity	notes (hazards given in this column are for the raw materials)
	FB 1	150 cm ³	0.060 mol dm ⁻³ acidified iron(III) chloride	Dissolve 16.22 g of FeCl ₃ ·6H ₂ O [C] in each dm ³ of 0.20 mol dm⁻³ hydrochloric acid . 0.20 mol dm ⁻³ hydrochloric acid made by diluting 2.0 mol dm ⁻³ hydrochloric acid [H] (preparation instructions on page 63 of the 2015 syllabus) 10-fold.
	FB 2	80 cm ³	0.060 mol dm ⁻³ potassium iodide	Dissolve 9.96 g of KI in each dm ³ of solution.
	FB 3	150 cm ³	0.0060 mol dm ⁻³ sodium thiosulfate	Dissolve 29.78 g of Na ₂ S ₂ O ₃ ·5H ₂ O in each dm ³ of solution. Dilute this solution 20-fold.
	starch indicator	80 cm ³	starch indicator	See preparation instructions on page 64 of the 2015 syllabus.
[H][N]	FB 4	1 g	mixture of equal mass of hydrated copper(II) sulfate and ammonium chloride	Mix equal masses of CuSO ₄ ·5H ₂ O [H] [N] and NH ₄ Cl [H]. Grind the solid mixture to ensure homogeneity. Approximately 1 g should be provided in a stoppered container.
[H]	FB 5	1 g	iron(II) ammonium sulfate	Approximately 1 g of Fe(NH ₄) ₂ (SO ₄) ₂ ·6H ₂ O [H] should be provided in a stoppered container.
*[H][F]	FB 6	5 cm ³	0.1 mol dm ⁻³ glucose	Dissolve 18.0 g of C ₆ H ₁₂ O ₆ in each dm ³ of solution.
	aqueous edta	5 cm ³	0.5 mol dm ⁻³ edta (ethylenediaminetetraacetic acid) or disodium edta	Dissolve 146.0 g C ₁₀ H ₁₆ N ₂ O ₈ [H] or 168.0 g C ₁₀ H ₁₄ N ₂ O ₈ Na ₂ in each dm ³ of solution.
	distilled water	150 cm ³	distilled water	

*These labels should be used, despite them being incorrect for glucose.

- 3 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
[H]	dilute hydrochloric acid	See identity details and preparation instructions on pages 63 and 64 of the 2015 syllabus.
[C]	dilute nitric acid	
[H]	dilute sulfuric acid	
	aqueous ammonia	
[C]	aqueous sodium hydroxide	
[H]	0.1 mol dm ⁻³ barium chloride or 0.1 mol dm ⁻³ barium nitrate	
	0.05 mol dm ⁻³ silver nitrate	
[H]	limewater	
[H]	acidified aqueous potassium manganate(VII)	
	0.1 mol dm ⁻³ potassium iodide	

- 4 The following materials and apparatus should be available.

red and blue litmus papers, plain filter paper strips for use with acidified manganate(VII), 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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REPORT FORM

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Centre number Name of Centre

1 Supervisor's Results

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

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