

9701/31

May/June 2011

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



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



[Turn over

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 plastic gloves should be used where necessary.

3 *For each candidate*

1 × 50 cm³ burette
1 × funnel (for filling burette)
1 × stand and burette clamp
1 × 25 cm³ bulb form pipette
1 × teat/squeeze/dropping pipette
1 × pipette filler
1 × 250 cm³ graduated (volumetric) flask, labelled **FA 3**
1 × white tile
2 × 250 cm³ glass beakers
2 × 250 cm³ conical flasks
1 × 25 cm³ measuring cylinder
1 × 50 cm³ measuring cylinder
2 × foamed plastic (expanded polystyrene) cup
1 × thermometer, −10 °C to +110 °C by 1 °C
1 × spatula
1 × glass rod
1 × heat-proof mat
1 × tripod and gauze
1 × Bunsen burner
2 × boiling tubes*
8 × test-tubes*
1 × hard glass test-tube, suitable to heat a solid
1 × test-tube rack
1 × test-tube holder
1 × wash bottle containing distilled water
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 refer to the raw materials)
[H]	FA 1	50 cm ³	0.64 mol dm ⁻³ sulfuric acid	Pour 35 cm ³ of concentrated sulfuric acid [C] slowly into 500 cm ³ of distilled water, with stirring, then make solution up to 1 dm ³ with distilled water. Care – concentrated H_2SO_4 is very corrosive.
[H]	FA 2	120 cm ³	0.150 mol dm ⁻³ sodium hydroxide	Dissolve 6.00 g of NaOH [C] in each dm ³ of solution with distilled water.
[F]	phenolphthalein	5 cm ³	phenolphthalein	Supplied in dropping bottles. See p 66 of the 2011 Syllabus for preparation instructions.
Check on suitability of reagents.				
Check, and adjust where necessary, the concentration of FA 1 by titrating 10.0 cm ³ of FA 1 with 0.500 mol dm ⁻³ NaOH (20.0 g dm ⁻³) using phenolphthalein indicator. Adjust the concentration of FA 1 to give a titration reading of between 24.0 and 27.0 cm ³ .				
[H]	FA 4	125 cm ³	0.64 mol dm ⁻³ sulfuric acid	This is 125 cm ³ of FA 1 after the concentration adjustment.
[F]	FA 5	0.6–0.7 g × 2	magnesium turnings	Each candidate should be provided with two stoppered tubes/bottles, labelled FA 5 , and containing 0.6–0.7 g of Mg [F].
	FA 6	1.8–1.9 g	magnesium oxide	Each candidate should be provided with a stoppered tube/bottle, labelled FA 6 , and containing 1.8–1.9 g of MgO.
[O] [H]	FA 7	1.0 g	zinc nitrate	Each candidate should be provided with a stoppered tube/bottle, labelled FA 7 , and containing about 1.0 g of freshly purchased $Zn(NO_3)_2 \cdot 6H_2O$ [O] [H].
[H] [N]	FA 8	0.5 g	copper(II) sulfate	Each candidate should be provided with a stoppered tube/bottle, labelled FA 8 , and containing about 0.5 g of $CuSO_4 \cdot 5H_2O$ [H] [N].

NOTE: The laboratory must be well ventilated.

3 The reagents below should also be provided. 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 the 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 page 65 and 66 of the 2011 syllabus. <i>Starch indicator should be prepared but labelled as starch solution.</i>
[C]	dilute nitric acid	
[H]	dilute sulfuric acid	
[H]	aqueous ammonia	
[C]	aqueous sodium hydroxide	
[T]	0.1 mol dm⁻³ barium chloride	
[H]	0.1 mol dm⁻³ barium nitrate	
[H] [N]	0.05 mol dm⁻³ silver nitrate	
	0.1 mol dm⁻³ potassium iodide	
[H]	limewater	
[T] [H]	acidified aqueous potassium dichromate(VI)	
	starch solution	

4 The following materials and apparatus should be available.

red and blue litmus paper, plain filter paper strips for use with dichromate(VI), aluminium foil for testing for 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 set 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 Report 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 – a minor handicap, relatively common in males – 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 for this handicap.

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.



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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

CHEMISTRY

9701/32

Advanced Practical Skills

May/June 2011

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by e-mail: international@cie.org.uk

by phone: +44 1223 553554

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

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



Safety

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2 Preparation of materials

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

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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 × 50 cm³ burette
 - 1 × 50 cm³ measuring cylinder
 - 1 × 25 cm³ measuring cylinder
 - 1 × stand and burette clamp
 - 1 × 25 cm³ bulb form pipette
 - 1 × pipette filler
 - 1 × 250 cm³ graduated (volumetric) flask
 - 1 × funnel (for filling burette)
 - 2 × 250 cm³ beaker
 - 1 × teat/squeeze/dropping pipette
 - 2 × 250 cm³ conical flasks
 - 1 × foamed plastic (expanded polystyrene) cup
 - 1 × −10 °C to +110 °C at 1 °C thermometer
 - 1 × test-tube rack
 - 1 × test-tube holder
 - 9 × test-tubes*
 - 1 × boiling tube*
 - 1 × spatula
 - 1 × heatproof mat
 - 1 × Bunsen burner
 - 1 × glass rod
 - 1 × wash bottle containing distilled water
 - 1 × white tile
 - paper towels
 - access to a balance weighing to 0.1 g or better

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

Where access to a balance is limited candidates should be directed to start the practical examination on different questions. (See p62 of the 2011 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 refer to the raw materials)
[H]	FB 1	7.3–7.5 g	hydrated sodium carbonate	Between 7.3 and 7.5 g powdered $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ [H] in a stoppered container. The solid should be from a freshly opened bottle.
	FB 2	150 cm ³	0.20 mol dm ⁻³ hydrochloric acid	Dilute 17.0 cm ³ of concentrated (35–37% approximately 11 mol dm ⁻³) acid [C] to 1 dm ³ .
	methyl orange indicator	3 cm ³	methyl orange indicator	See preparation instructions on page 66 of the 2011 syllabus.
[H]	FB 3	10.0 to 10.2 g	hydrated sodium carbonate	Between 10.0 and 10.2 g of powdered $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ [H] in a stoppered container. The solid should be from a freshly opened bottle.
[H]	FB 4	30 cm ³	4.0 mol dm ⁻³ hydrochloric acid	Dilute 340 cm ³ of concentrated (35–37% approximately 11 mol dm ⁻³) acid [C] to 1 dm ³ .
[F]	magnesium	4 × 1 cm pieces	magnesium ribbon	Clean the magnesium ribbon [F] lightly with emery paper to remove oxide layer.
	FB 5	10 cm ³	0.1 mol dm ⁻³ magnesium sulfate	Dissolve 24.6 g of $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ in each dm ³ of solution.
[T] [N]	FB 6	10 cm ³	0.1 mol dm ⁻³ lead nitrate	Dissolve 33.1 g of $\text{Pb}(\text{NO}_3)_2$ [T] [O] [N] in each dm ³ of solution.
	FB 7	10 cm ³	0.1 mol dm ⁻³ aluminium sulfate	Dissolve 63.0 g of $\text{Al}_2(\text{SO}_4)_3 \cdot 16\text{H}_2\text{O}$ in each dm ³ of solution.
[H]	FB 8	3 g	ammonium iron(II) sulfate	Approx. 3 g of $(\text{NH}_4)_2\text{Fe}(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$ [H] in a stoppered container.
	hydrogen peroxide	10 cm ³	5 vol hydrogen peroxide	Dilute 100 vol H_2O_2 [H] by a factor of 20.

3 The reagents below should also be provided. 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 the 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 page 65 and 66 of the 2011 syllabus.
[C]	dilute nitric acid	
[H]	dilute sulfuric acid	
[H]	aqueous ammonia	
[C]	aqueous sodium hydroxide	
[T]	0.1 mol dm⁻³ barium chloride	
[H]	or 0.1 mol dm⁻³ barium nitrate	
[H] [N]	0.05 mol dm⁻³ silver nitrate	
[T] [N]	0.1 mol dm⁻³ lead(II) nitrate	
	0.1 mol dm⁻³ potassium iodide	

4 The following materials and apparatus should be available.

red and blue litmus paper, plain filter paper strips for use with dichromate(VI), aluminium foil for testing for 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 × 250 cm³ beaker
2 × 250 cm³ conical flask
1 × 50 cm³ measuring cylinder
1 × 250 cm³ graduated (volumetric) flask
3 × teat/squeeze/dropping pipette
1 × 50 cm³ burette
1 × stand and burette clamp
1 × small funnel for filling burette
1 × 25 cm³ bulb form pipette
1 × pipette filler
1 × small funnel
1 × white tile
1 × heat proof mat
1 × Bunsen burner
1 × tripod
1 × pipe-clay triangle
1 × crucible (at least 15 cm³ capacity)
1 × pair of crucible tongs
1 × spatula
3 × boiling tube*
6 × test-tube*
1 × test-tube holder
1 × test-tube rack
1 × wash bottle containing distilled water
paper towels
access to a balance weighing to 0.1 g or better

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

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Chemicals Required

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2 Particular requirements

hazard	label	per candidate	identity	notes (hazards given in this column refer to the raw materials)
[H]	FA 1	5.80–5.90 g	ammonium iron(II) sulfate	5.80–5.90 g of $(\text{NH}_4)_2\text{SO}_4 \cdot \text{FeSO}_4 \cdot 6\text{H}_2\text{O}$ [H] should be finely ground and provided in a stoppered tube.
[H]	FA 2	250 cm ³	1 mol dm ⁻³ sulfuric acid	Cautiously pour 55 cm ³ of concentrated (98%) sulfuric acid [C] into 500 cm ³ of distilled water with continuous stirring. Make the solution up to 1 dm ³ with distilled water. Care: Concentrated H_2SO_4 is very corrosive.
[N]	FA 3	150 cm ³	0.010 mol dm ⁻³ potassium manganate (VII)	Dissolve 1.58 g of KMnO_4 [N] [O] [H] in each dm ³ of distilled water.
	FA 4	1.5 g	9 parts $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ to 1 part anhydrous Na_2SO_4 by mass	a finely ground mixture of 9 parts by mass hydrated magnesium sulfate, $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$, to 1 part by mass anhydrous sodium sulfate, Na_2SO_4
	FA 5	2.5 g	sodium hydrogencarbonate	finely ground NaHCO_3 provided in a stoppered tube
	FA 6	1.5 g	ammonium bromide	finely ground NH_4Br provided in a stoppered tube
[H]	FA 7	10 cm ³	1 mol dm ⁻³ sulfuric acid	Cautiously pour 55 cm ³ of concentrated (98%) sulfuric acid [C] into 500 cm ³ of distilled water with continuous stirring. Make the solution up to 1 dm ³ with distilled water. Care: Concentrated H_2SO_4 is very corrosive.

NOTE: The laboratory must be well ventilated

3 The reagents below should also be provided. 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 the contamination of reagents and enhance the opportunity for malpractice between candidates.

hazard	label	per candidate	notes (hazards given in this column refer to the raw materials)
[C]	concentrated sulfuric acid	1 cm ³	Care: Concentrated H_2SO_4 is very corrosive.
[T] [N]	0.1 mol dm⁻³ potassium chromate(VI)	10 cm ³	Dissolve 19.4 g of K_2CrO_4 [T] [N] in each dm ³ of solution.
[H]	dilute hydrochloric acid	See identity details and preparation instructions on page 65 and 66 of the 2011 syllabus	
[C]	dilute nitric acid		
[H]	dilute sulfuric acid		
[H]	aqueous ammonia		
[C]	aqueous sodium hydroxide		
[T]	0.1 mol dm⁻³ barium chloride or		
[H]	0.1 mol dm⁻³ barium nitrate		
[T] [N]	0.1 mol dm⁻³ lead(II) nitrate		
[H] [N]	0.05 mol dm⁻³ silver nitrate		
[H]	limewater		
[T] [N]	acidified aqueous potassium dichromate(VI)		

4 The following materials and apparatus should be available.

red and blue litmus paper, plain filter paper strips for use with dichromate(VI), aluminium foil for testing for 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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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 Report 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 – a minor handicap, relatively common in males – it is permissible to advise candidates to 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 for this handicap.

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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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

CHEMISTRY

9701/34

Advanced Practical Skills

May/June 2011

CONFIDENTIAL INSTRUCTIONS

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



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: international@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 pages 4 and 5 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 plastic gloves should be used where necessary.

3 *For each candidate*

1 × 25 cm³ bulb form pipette
1 × pipette filler
2 × 50 cm³ burette
2 × funnel (for filling burettes)
2 × stand and burette clamp
1 × 250 cm³ graduated (volumetric) flask, labelled **FB 2**
2 × 250 cm³ conical flask
1 × white tile
1 × 25 cm³ measuring cylinder
1 × 50 cm³ measuring cylinder
1 × stop clock (stop watch) or sight of a clock with a seconds display
1 × 100 cm³ beaker [All beakers must be the same form, squat or tall.]
1 × test-tube holder
12 × test-tubes*
2 × hard glass test-tubes*
2 × rubber bungs to fit test-tubes
1 × boiling tube*
1 × test-tube rack
2 × teat/squeeze/dropping pipettes
1 × spatula
1 × glass rod
1 × evaporating basin
1 × Bunsen burner
1 × tripod and gauze
1 × heat proof mat
1 × wash bottle containing distilled water
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 refer to the raw materials)
	FB 1	180 cm ³	0.14 mol dm ⁻³ sodium thiosulfate	Dissolve 35.60 g of Na ₂ S ₂ O ₃ ·5H ₂ O in each dm ³ of solution.
	FB 3	150 cm ³	0.005 mol dm ⁻³ potassium manganate(VII)	Dissolve 0.79 g of KMnO ₄ in each dm ³ of solution. [O][H][N]
	FB 4	70 cm ³	0.1 mol dm ⁻³ potassium iodide	Dissolve 16.6 g of KI in each dm ³ of solution.
[H]	FB 5	100 cm ³	1.0 mol dm ⁻³ sulfuric acid	Cautiously pour 55 cm ³ of concentrated (98%) sulfuric acid [C] into 500 cm ³ of distilled water with continuous stirring. Make the solution up to 1 dm ³ with distilled water Care: concentrated H₂SO₄ is very corrosive.
	FB 6	180 cm ³	0.1 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. <i>The solid should be dissolved in boiled distilled water that has been cooled in a closed vessel. This prevents oxidation of the thiosulfate by dissolved oxygen.</i>
Check on suitability of reagents				
1 17.5 cm ³ sodium thiosulfate (FB 1) should react with 25 cm ³ 0.050 mol dm ⁻³ aqueous iodine. A 0.050 mol dm ⁻³ solution of aqueous iodine can be prepared by dissolving 12.70 g of iodine in a solution of 20 g potassium iodide in 30 cm ³ of water and then making the solution up to 1 dm ³ .				
2 45 cm ³ sodium thiosulfate (FB 6) with 10 cm ³ 1.0 mol dm ⁻³ sulfuric acid should obscure a cross placed under a 100 cm ³ beaker containing the mixture in not less than 20 s.				
	FB 7	10 cm ³	0.2 mol dm ⁻³ aluminium sulfate	Dissolve 90.0 g of Al ₂ (SO ₄) ₃ ·6H ₂ O (or 126 g of Al ₂ (SO ₄) ₃ ·16H ₂ O) in each dm ³ of solution.
	FB 8	10 cm ³	0.5 mol dm ⁻³ zinc nitrate	Dissolve 148.7 g of Zn(NO ₃) ₂ ·16H ₂ O [O][H] (or 238.7 g of Zn(NO ₃) ₂ ·6H ₂ O) [O][H] in each dm ³ of solution.
[T] [N]	FB 9	10 cm ³	0.2 mol dm ⁻³ lead nitrate	Dissolve 66.2 g of Pb(NO ₃) ₂ [T][O][N] in each dm ³ of solution.
	FB 10	2 g	anhydrous sodium hydrogen carbonate	Provided in a stoppered tube

NOTE: The laboratory must be well ventilated.

- 3** The reagents below should also be provided. 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 the contamination of reagents and enhance the opportunity for malpractice between candidates.

hazard	label	identity	notes (hazards given in this column refer to the raw materials)
	starch indicator	starch 'solution'	1% by mass starch and distilled water, supplied in a dropping bottle
	aluminium sulfate	0.2 mol dm ⁻³ Al ₂ (SO ₄) ₃	Made as for FB 7
[N]	copper(II) sulfate	0.5 mol dm ⁻³ CuSO ₄	Dilute 124.8 g of CuSO ₄ ·5H ₂ O [H][N] in each dm ³ of solution
[T][N]	0.1 mol dm⁻³ potassium chromate(VI)	0.1 mol dm ⁻³ K ₂ CrO ₄	Dissolve 19.4 g of K ₂ CrO ₄ [T][N] in each dm ³ of solution.
[H]	dilute hydrochloric acid	See identity details and preparation instructions on pages 65 and 66 of the 2011 syllabus	
[C]	dilute nitric acid		
[H]	dilute sulfuric acid		
[H]	aqueous ammonia		
[C]	aqueous sodium hydroxide		
[T]	0.1 mol dm⁻³ barium chloride or		
[H]	0.1 mol dm⁻³ barium nitrate		
[H][N]	0.05 mol dm⁻³ silver nitrate		
[H]	limewater		
[T][N]	acidified aqueous potassium dichromate(VI)		

- 4** The following materials and apparatus should be available.

red and blue litmus paper, plain filter paper strips for use with dichromate(VI), aluminium foil for testing for 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 set 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 Report 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 – a minor handicap, relatively common in males – 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 for this handicap.

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 index numbers of candidates attending each session were:

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

CHEMISTRY

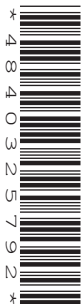
9701/35

Advanced Practical Skills

May/June 2011

CONFIDENTIAL INSTRUCTIONS

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



The Supervisor's attention is drawn to the form on page 9 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: international@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 **9** printed pages and **3** blank 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 'General Apparatus' on the use of pipette fillers and safety goggles.

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.

Preparing 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 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 also be noted that descriptions of solutions given in the question paper may not correspond exactly with the specification 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 plastic gloves should be used where necessary.

3 *For each candidate*

1 × 25 cm³ bulb form pipette
1 × pipette filler
1 × 250 cm³ graduated (volumetric) flask labelled **FA 3**
2 × 250 cm³ conical flask
2 × 50 cm³ burette
2 × stand and burette clamp
2 × funnel (for filling burette)
1 × white tile
1 × 250 cm³ beaker
1 × clean, dry, weighing bottle or tube
1 × expanded polystyrene or other foamed plastic cup
1 × thermometer, −10 °C to 110 °C by 1 °C
1 × 50 cm³ measuring cylinder
1 × test-tube holder
2 × boiling tubes*
12 × test-tubes*
1 × test-tube rack
3 × teat/squeeze/dropping pipettes
1 × wash bottle containing distilled water
1 × marker pen (for labelling test-tubes)
1 × spatula
paper towels
access to a balance weighing to 0.1 g or better

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

Where access to a balance is limited candidates should be directed to start the practical examination on different questions. (See p 62 of the 2011 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 refer to the raw materials)
	FA 1	150 cm ³	0.10 mol dm ⁻³ "borax", disodium tetraborate	Dissolve 38.10 g of Na ₂ B ₄ O ₇ ·10H ₂ O in each dm ³ of solution. <i>The solid needs grinding to a fine powder before adding to water and warming to dissolve. The solution should be filtered if necessary.</i>
	FA 2	60 cm ³	1.0 mol dm ⁻³ hydrochloric acid	Dilute 85 cm ³ of concentrated (35–37%; approximately 11 mol dm ⁻³) acid [C] to 1 dm ³ .
	Indicator, labelled with its identity	10 cm ³	Indicator, normally used in the Centre for a strong acid/weak base titration	Methyl orange or bromophenol blue are suitable indicators. See p 66 of the 2011 Syllabus for preparation instructions.
Check on suitability of reagents. Check, and adjust where necessary, the concentration of FA 2 by titrating 50.0 cm ³ of FA 1 with FA 2 using methyl orange or bromophenol blue as indicator. Adjust the concentration of FA 2 to give a titration reading of 10.00 ± 0.20 cm ³ .				
[H]	FA 4	6 g	anhydrous sodium carbonate	Each candidate should be provided with a stoppered tube, labelled FA 4, and containing 6.0 ± 0.1 g of Na₂CO₃ [H] . <i>The sodium carbonate should be heated in an oven at 100°C for one hour to remove any absorbed water. It should then be cooled in a desiccator or other closed container.</i>
	FA 5	9 g	sodium hydrogencarbonate	Each candidate should be provided with a stoppered tube, labelled FA 5, and containing 9.0 ± 0.1 g of NaHCO₃ .
[H]	FA 6	10 g	a mixture of sodium carbonate and sodium hydrogencarbonate	An intimate mixture of 1 part anhydrous sodium carbonate [H] by mass to 2 parts sodium hydrogencarbonate by mass. <i>The sodium carbonate should be dried as for FA 4. Ensure the mixture is as uniform as possible.</i>
[H]	FA 7	200 cm ³	3.0 mol dm ⁻³ hydrochloric acid	Dilute 255 cm ³ of concentrated (35–37%; approximately 11 mol dm ⁻³) acid [C] to 1 dm ³

2 Particular requirements continued

hazard	label	per candidate	identity	notes (hazards given in this column refer to the raw materials)
	FA 8	20 cm ³	1.0 mol dm ⁻³ sodium chloride (or potassium chloride)	Dissolve 58.5 g of NaCl (or 74.6 g of KCl) in each dm ³ of solution
[H] [N]	FA 9	20 cm ³	1.0 mol dm ⁻³ sodium nitrite	Dissolve 69.0 g of NaNO ₂ [T] [N] [O] in each dm ³ of solution.
	FA 10	20 cm ³	1.0 mol dm ⁻³ sodium bromide (or potassium bromide)	Dissolve 103 g of NaBr (or 119 g of KBr) in each dm ³ of solution.
[N]	FA 11	20 cm ³	0.2 mol dm ⁻³ copper(II) sulfate	Dissolve 49.9 g of CuSO ₄ .5H ₂ O [H] [N] in each dm ³ of solution.
	FA 12	20 cm ³	0.2 mol dm ⁻³ magnesium sulfate	Dissolve 49.3 g of MgSO ₄ .7H ₂ O in each dm ³ of solution.
	aqueous sodium thiosulfate	10 cm ³	0.2 mol dm ⁻³ sodium thiosulfate	Dissolve 49.6 g of Na ₂ S ₂ O ₃ .5H ₂ O in each dm ³ of solution. <i>The solid should be dissolved in boiled distilled water that has been cooled in a closed vessel – this prevents aerial oxidation of the thiosulfate by dissolved oxygen.</i>

NOTE: The laboratory must be well ventilated

3 The reagents below should also be provided. 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 the 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 page 65 and 66 of the 2011 syllabus.
[C]	dilute nitric acid	
[H]	dilute sulfuric acid	
[H]	aqueous ammonia	
[C]	aqueous sodium hydroxide	
[T]	0.1 mol dm⁻³ barium chloride	
[H]	0.1 mol dm⁻³ barium nitrate	
[H] [N]	0.05 mol dm⁻³ silver nitrate	
[T] [N]	0.1 mol dm⁻³ lead(II) nitrate	
	0.1 mol dm⁻³ potassium iodide	
	starch solution	<i>Starch indicator should be prepared but labelled as starch solution</i>

4 The following materials and apparatus should be available.

red and blue litmus paper, plain filter paper strips for use with dichromate(VI), aluminium foil for testing for 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 the 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 set 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 9 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 10 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 Report relevant to the candidates in 1.
- 3 A copy of the Report Form, including details of any difficulties experienced by candidates (see pages 9 and 10).
- 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 – a minor handicap, relatively common in males – 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 for this handicap.

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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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