



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

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**CHEMISTRY**

**9701/31**

Paper 31 Advanced Practical Skills

**May/June 2008**

**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: [International@cie.org.uk](mailto: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.

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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, first-aid and disposal of chemicals.

'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 **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*

2 × 50 cm<sup>3</sup> burettes  
2 × burette clamps  
2 × stands  
2 × funnels for filling burettes  
1 × 250 cm<sup>3</sup> conical flask  
1 × measuring cylinder to measure 10 cm<sup>3</sup>  
1 × 25 cm<sup>3</sup> pipette  
1 × pipette filler or equivalent safety device  
1 × white tile  
1 × wash bottle containing distilled water  
12 × test-tubes  
3 × boiling-tubes  
1 × test-tube rack  
1 × test-tube holder  
1 × Bunsen burner  
1 × heat proof mat  
1 × 250 cm<sup>3</sup> beaker  
2 × teat/squeeze pipettes  
paper towels

### 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 (Hazard symbols given are for the raw materials.)
[H]	FA 1	250 cm <sup>3</sup>	0.04 mol dm <sup>-3</sup> ammonium iron(II) sulphate	Dissolve 15.68 g of (NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub> ·6H <sub>2</sub> O in 250 cm <sup>3</sup> of 1.0 mol dm <sup>-3</sup> H <sub>2</sub> SO <sub>4</sub> [H], then make the solution up to 1 dm <sup>3</sup> with distilled water.
[H] [N] [O]	FA 2	100 cm <sup>3</sup>	0.015 mol dm <sup>-3</sup> potassium manganate(VII)	Dissolve 2.37 g of KMnO <sub>4</sub> [O][H][N] in each dm <sup>3</sup> of solution.
[H]	FA 3	250 cm <sup>3</sup>	0.025 mol dm <sup>-3</sup> hydrogen peroxide	Dilute 30 cm <sup>3</sup> of “10 volume” (3% w/w) hydrogen peroxide [H] to 1 dm <sup>3</sup> . If the original solution is “100 volume” (30% w/w) [C] first dilute to “10 volume” and prepare FA 3 as above. <i>This solution should be prepared as late as possible, stored in cool conditions and kept out of direct sunlight.</i>
<b>Check and adjust the concentration of FA 3. Titrate a mixture of 25.0 cm<sup>3</sup> of FA 3 and 10 cm<sup>3</sup> of 1.0 mol dm<sup>-3</sup> sulphuric acid with FA 2. Adjust the concentration of FA 3 to give a titre of between 16 and 17 cm<sup>3</sup>.</b>				
[C]	1.0 mol dm <sup>-3</sup> H <sub>2</sub> SO <sub>4</sub>	100 cm <sup>3</sup>	1.0 mol dm <sup>-3</sup> H <sub>2</sub> SO <sub>4</sub>	Cautiously pour 55 cm <sup>3</sup> of concentrated (98%) sulphuric acid [C] into 500 cm <sup>3</sup> of distilled water with continuous stirring. Make the solution up to 1 dm <sup>3</sup> with distilled water. <b>Care</b> – concentrated H <sub>2</sub> SO <sub>4</sub> [C] is very corrosive.
[H]	FA 4	30 cm <sup>3</sup>	0.1 mol dm <sup>-3</sup> aluminium sulphate	Dissolve 63.0 g of Al <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub> ·16H <sub>2</sub> O [H] in each dm <sup>3</sup> of solution.
[C]	FA 5	30 cm <sup>3</sup>	0.1 mol dm <sup>-3</sup> zinc nitrate	Dissolve 29.8 g of Zn(NO <sub>3</sub> ) <sub>2</sub> ·6H <sub>2</sub> O [C] in each dm <sup>3</sup> of solution.
[H]	FA 6	30 cm <sup>3</sup>	0.1 mol dm <sup>-3</sup> sodium iodide (or 0.1 mol dm <sup>-3</sup> potassium iodide)	Dissolve 15.0 g of NaI [H] (or 16.6 g of KI [H]) in each dm <sup>3</sup> of solution.

**3** The standard bench reagents specifically required are set out below. 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 enhance the opportunity for malpractice between candidates.

hazard	label	identity	notes
[C]	<b>dilute nitric acid</b>	2.0 mol dm <sup>-3</sup> HNO <sub>3</sub>	Dilute 128 cm <sup>3</sup> of concentrated (70% w/v) acid <b>[C][O]</b> to 1 dm <sup>3</sup> .
[C]	<b>aqueous sodium hydroxide</b>	2.0 mol dm <sup>-3</sup> NaOH	Dissolve 80.0 g of NaOH <b>[C]</b> in each dm <sup>3</sup> of solution. <b>Care</b> – the process of solution is <i>exothermic and any concentrated solution is very corrosive</i> .
[H]	<b>aqueous ammonia</b>	2.0 mol dm <sup>-3</sup> NH <sub>3</sub>	Dilute 112 cm <sup>3</sup> of concentrated (35%) ammonia <b>[C][N]</b> to 1 dm <sup>3</sup> .
[H]	<b>dilute hydrochloric acid</b>	2.0 mol dm <sup>-3</sup> HCl	Dilute 172 cm <sup>3</sup> of concentrated (35%–37%) acid <b>[C]</b> to 1 dm <sup>3</sup> .
[T]	<b>0.1 mol dm<sup>-3</sup> barium chloride</b> [or 0.1 mol dm <sup>-3</sup> barium nitrate]	0.1 mol dm <sup>-3</sup> barium chloride [or 0.1 mol dm <sup>-3</sup> barium nitrate]	Dissolve 24.4 g of BaCl <sub>2</sub> ·2H <sub>2</sub> O <b>[T]</b> in each dm <sup>3</sup> of solution. [Or dissolve 26.1 g of Ba(NO <sub>3</sub> ) <sub>2</sub> <b>[H][O]</b> in each dm <sup>3</sup> of solution.]
[H] [N]	<b>0.05 mol dm<sup>-3</sup> silver nitrate</b>	0.05 mol dm <sup>-3</sup> silver nitrate	Dissolve 8.5 g of AgNO <sub>3</sub> <b>[C][N]</b> in each dm <sup>3</sup> of solution.
[T] [N]	<b>0.1 mol dm<sup>-3</sup> lead(II) nitrate</b>	0.1 mol dm <sup>-3</sup> lead(II) nitrate	Dissolve 33.1 g of Pb(NO <sub>3</sub> ) <sub>2</sub> <b>[T][N]</b> in each dm <sup>3</sup> of solution.

The reagents, materials and apparatus to test the gases listed in the syllabus must be available to candidates. 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 enhance the opportunity for malpractice between candidates.

hazard	label	identity	notes
[H]	<b>limewater</b>	saturated aqueous calcium hydroxide, Ca(OH) <sub>2</sub>	Prepare fresh limewater by leaving distilled water to stand over solid calcium hydroxide <b>[H]</b> for several days, shaking occasionally. Decant or filter the solution.
[T] [N]	<b>acidified aqueous potassium dichromate(VI)</b>	0.05 mol dm <sup>-3</sup> K <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub> 0.05 mol dm <sup>-3</sup> H <sub>2</sub> SO <sub>4</sub>	Dissolve 14.8 g of K <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub> <b>[T][N]</b> in 50 cm <sup>3</sup> of 1 mol dm <sup>-3</sup> sulphuric acid <b>[H]</b> . Make the solution up to 1 dm <sup>3</sup> with distilled water. <i>The use of plastic gloves may be considered to prevent contact with skin.</i>
red and blue litmus paper, plain filter paper strips for use with dichromate, wooden splints, the apparatus normally used in the Centre for use with limewater in testing for carbon dioxide			

[Turn over]

### Responsibilities of the Supervisor during the Examination

- 1 The Supervisor, or other competent chemist **must carry out the experiments in question 1** 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 each 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 index 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** 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:**

*First Session*

*Second Session*

**3 The Supervisor is required to give details overleaf of any difficulties experienced by particular candidates, giving names and index 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 number 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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