



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
Cambridge International Level 3 Pre-U Certificate  
Principal Subject

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**CHEMISTRY**

**9791/04**

Paper 4 Practical

**May/June 2011**

CONFIDENTIAL INSTRUCTIONS

**Great care should be taken to ensure that any 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 11 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.

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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 '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 concentrations accurate to within one part in two hundred of those specified.

**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.

**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 in preparing 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 cm<sup>3</sup> burette
- 1 × small funnel for filling burette
- 1 × 25 cm<sup>3</sup> pipette
- 1 × pipette filler
- 1 × 250 cm<sup>3</sup> conical flask
- 2 × 250 cm<sup>3</sup> beaker
- 1 × white tile
- 1 × foamed plastic (expanded polystyrene) cup
- 1 × 50 cm<sup>3</sup> measuring cylinder
- 1 × −10 °C to 110 °C thermometer
- 8 × test-tubes
- 3 × teat/dropping pipettes
- 1 × test-tube holder
- 1 × test-tube bung
- suitable container for test-tubes
- 1 × heat-proof mat
- 1 × Bunsen burner
- 1 × tripod
- 1 × gauze
- 1 × wash bottle of distilled water
- paper towels

access to balance, single-pan, direct reading, minimum accuracy 0.1 g (1 per 8–12 candidates)

## 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 in this column refer to the raw materials.)
<b>FA 1</b>		150 cm <sup>3</sup>	0.0250 mol dm <sup>-3</sup> iodine	Dissolve 20 g of potassium iodide in 400 cm <sup>3</sup> of water and add 6.35 g of iodine <b>[N]</b> <b>[H]</b> . To see that the iodine has dissolved pour the solution from one beaker to another.  Once all the iodine has dissolved make up to 1 dm <sup>3</sup> with water.
<b>FA 2</b>		150 cm <sup>3</sup>	0.0500 mol dm <sup>-3</sup> sodium thiosulfate	Dissolve 12.4 g of Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> ·5H <sub>2</sub> O in each dm <sup>3</sup> of distilled water.  <i>The distilled water used to make up this solution should be boiled to eliminate dissolved air and covered while cooling to prevent any carbon dioxide dissolving. Acidity in the water can lead to decomposition of the thiosulfate.</i>
<b>starch indicator</b>		10 cm <sup>3</sup>	2% w/v starch solution	Make a paste from 20 g of soluble starch and 50 cm <sup>3</sup> of distilled water taken from 1 dm <sup>3</sup> . Boil the remaining water and pour in the paste with stirring. Reheat to boiling before allowing to cool to room temperature.
<b>FA 3</b>		ca. 2 g	zinc powder	A stoppered weighing bottle containing between 1.90 and 2.10 g of powdered zinc.
<b>[H]</b> <b>[N]</b>		50 cm <sup>3</sup>	1.00 mol dm <sup>-3</sup> copper sulfate	Dissolve 249.7 g of CuSO <sub>4</sub> ·5H <sub>2</sub> O <b>[H]</b> <b>[N]</b> in each dm <sup>3</sup> of solution.

hazard	label	per candidate	identity	notes (Hazard symbols given in this column refer to the raw materials.)
[T] [N]	FA 5	20 cm <sup>3</sup>	0.1 mol dm <sup>-3</sup> magnesium chloride	Dissolve 20.3 g of MgCl <sub>2</sub> ·6H <sub>2</sub> O in each dm <sup>3</sup> of solution.
	FA 6	20 cm <sup>3</sup>	0.1 mol dm <sup>-3</sup> aluminium sulfate	Dissolve 63.0 g of Al <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub> ·16H <sub>2</sub> O in each dm <sup>3</sup> of solution.
	FA 7	20 cm <sup>3</sup>	0.05 mol dm <sup>-3</sup> sodium sulfite and 0.05 mol dm <sup>-3</sup> sodium chloride	Mix equal volumes of 0.1 mol dm <sup>-3</sup> Na <sub>2</sub> SO <sub>3</sub> and 0.1 mol dm <sup>-3</sup> NaCl. Dissolve 12.6 g of Na <sub>2</sub> SO <sub>3</sub> [H] in each dm <sup>3</sup> of solution. Dissolve 5.84 g of NaCl in each dm <sup>3</sup> of solution.
[T] [N]	FA 8	20 cm <sup>3</sup>	0.1 mol dm <sup>-3</sup> lead(II) nitrate	Dissolve 33.1 g of Pb(NO <sub>3</sub> ) <sub>2</sub> [T] [O] [N] in each dm <sup>3</sup> of solution.
[C]	FA 9	20 cm <sup>3</sup>	3.0 mol dm <sup>-3</sup> methanoic acid	Dilute 126 cm <sup>3</sup> of methanoic acid (90%) [C] to 1 dm <sup>3</sup> with distilled water.
[H] [N]	acidified potassium manganate(VII)	10 cm <sup>3</sup>	0.005 mol dm <sup>-3</sup> KMnO <sub>4</sub> and 0.75 mol dm <sup>-3</sup> H <sub>2</sub> SO <sub>4</sub>	For each dm <sup>3</sup> , mix 250 cm <sup>3</sup> of 0.02 mol dm <sup>-3</sup> KMnO <sub>4</sub> with 750 cm <sup>3</sup> of 1.00 mol dm <sup>-3</sup> sulfuric acid. 0.02 mol dm <sup>-3</sup> KMnO <sub>4</sub> can be prepared by dissolving 3.16 g of KMnO <sub>4</sub> [N] [O] [H] in each dm <sup>3</sup> of solution. 1.00 mol dm <sup>-3</sup> sulfuric acid may be prepared by cautiously pouring 55 cm <sup>3</sup> of concentrated (98%) sulfuric acid [C] into 500 cm <sup>3</sup> of distilled water slowly with continuous stirring. Make the solution up to 1 dm <sup>3</sup> with distilled water.
	sodium hydrogencarbonate	2 g	sodium hydrogencarbonate	<b>Care – concentrated H<sub>2</sub>SO<sub>4</sub> [C] is very corrosive.</b>

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 Invigilator should be drawn to the fact that such an arrangement may enhance the opportunity for malpractice between candidates.

hazard	label	identity	notes (Hazard symbols given in this column refer to the raw materials.)
[H]	aqueous ammonia	2.0 mol dm <sup>-3</sup> NH <sub>3</sub>	Dilute 112 cm <sup>3</sup> of concentrated (35%) ammonia [C] [N] to 1 dm <sup>3</sup> .
[C]	aqueous sodium hydroxide	2.0 mol dm <sup>-3</sup> NaOH	Dissolve 80.0 g of NaOH [C] in each dm <sup>3</sup> of solution. <b>Care – the process is exothermic and any concentrated solution is very corrosive.</b>
[H]	dilute hydrochloric acid	2.0 mol dm <sup>-3</sup> HCl	Dilute 172 cm <sup>3</sup> of concentrated (35% w/w; approximately 11 mol dm <sup>-3</sup> ) acid [C] to 1 dm <sup>3</sup> .
[H] [N]	aqueous silver nitrate	0.05 mol dm <sup>-3</sup> silver nitrate	Dissolve 8.5 g of AgNO <sub>3</sub> [C] [N] in each dm <sup>3</sup> of solution.
[H]	aqueous barium chloride or aqueous 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 [T] in each dm <sup>3</sup> of solution. or Dissolve 26.1 g of Ba(NO <sub>3</sub> ) <sub>2</sub> [H] [O] in each dm <sup>3</sup> of solution.

### Responsibilities of the Supervisor during the Examination

- 1 The Supervisor, or other competent chemist **must carry out the experiments in question 1 and 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 11 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 12 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 11 and 12).
- 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 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 with 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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