

CHEMISTRY (PRINCIPAL)

9791/04

Paper 4 Practical

May/June 2015

CONFIDENTIAL INSTRUCTIONS

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

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: 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.

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 3 Pre-U Certificate.

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.

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 cm³ burette labelled **FA 1**
 - 1 × 50 cm³ burette unlabelled
 - 2 × burette clamps and stands
 - 1 × small funnel for filling burette
 - 1 × 25 cm³ measuring cylinder
 - 1 × 50 cm³ measuring cylinder
 - 2 × 100 cm³ beakers
 - 3 × dropping pipettes
 - 1 × stop clock or sight of a clock measuring to an accuracy of 1 second
 - 1 × glass rod
 - 1 × white tile
 - 3 × boiling tubes
 - 5 × test-tubes
 - 1 × test-tube holder
 - 1 × test-tube rack
 - 1 × spatula
 - 1 × filter funnel
 - 2 × filter papers
 - 1 × wash bottle of distilled water
 - 1 × pen for labelling glassware
 - paper towels
 - 1 × Bunsen burner
 - 1 × heat-proof mat

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
	FA 1	100 cm ³	1.0 mol dm ⁻³ potassium iodide	(Hazards symbols given in this column refer to the raw materials.) Dissolve 166 g of KI in each dm ³ of solution.
	FA 2	100 cm ³	0.10 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	120 cm ³	0.10 mol dm ⁻³ hydrogen peroxide	Dilute 11.5 cm ³ of '100 vol' hydrogen peroxide [C] to 1 dm ³ with distilled water.
[H]	FA 4	120 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: <i>concentrated H₂SO₄ is very corrosive.</i>
	starch indicator	10 cm ³	freshly prepared aqueous starch indicator (approx. 2% solution w/v)	Mix 2 g of soluble starch with a little cold water until a smooth paste is obtained. Add 100 cm ³ boiling water and stir. Boil until a clear solution is obtained (about 5 minutes).
[H]	FA 5	1.6 g	mixture of copper carbonate and manganese(II) chloride	Mix together 1.0 ± 0.1 g of basic copper carbonate, CuCO ₃ ·Cu(OH) ₂ , [H] and 0.6 ± 0.1 g of MnCl ₂ ·4H ₂ O [H]. Each candidate should be provided with the mixture in a stoppered bottle.
[H]	FA 6	0.5 g	sodium sulfite	Each candidate should be provided with approximately 0.5 g of Na ₂ SO ₃ [H] in a stoppered bottle.
	FA 7	10 cm ³	0.02 mol dm ⁻³ potassium manganate(VII)	Dissolve 3.16 g of KMnO ₄ [N] [O] [H] in each dm ³ of solution. Note: The solution should be prepared using distilled water and not sulfuric acid.
	distilled water	100 cm ³	distilled water	

N.B. Small amounts of SO₂ [**T**], which can cause respiratory distress in some people, may be produced. The laboratory should be well ventilated.

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 (Hazards symbols given in this column refer to the raw materials.)
[H]	dilute hydrochloric acid	$2.0 \text{ mol dm}^{-3} \text{ HCl}$	Dilute 172 cm^3 of concentrated (35% w/w; approximately 11 mol dm^{-3}) hydrochloric acid [C] [H] to 1 dm^3 .
[C]	dilute nitric acid	$2.0 \text{ mol dm}^{-3} \text{ HNO}_3$	Dilute 128 cm^3 of concentrated (70% w/v) nitric acid [C] [O] to 1 dm^3 .
[H]	dilute sulfuric acid	$1.0 \text{ mol dm}^{-3} \text{ H}_2\text{SO}_4$	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.
[C]	aqueous ammonia	$2.0 \text{ mol dm}^{-3} \text{ NH}_3$	Dilute 112 cm^3 of concentrated (35%) ammonia [C] [N] [H] to 1 dm^3 .
[C]	aqueous sodium hydroxide	$2.0 \text{ mol dm}^{-3} \text{ NaOH}$	Dissolve 80.0 g of NaOH [C] in each dm^3 of solution. Care – the process of solution is exothermic and any concentrated solution is very corrosive.
	aqueous silver nitrate	0.05 mol dm^{-3} silver nitrate	Dissolve 8.5 g of AgNO_3 [C] [N] [O] in each dm^3 of solution.
[H]	aqueous barium chloride or aqueous barium nitrate	0.1 mol dm^{-3} barium chloride or 0.1 mol dm^{-3} barium nitrate	Dissolve 24.4 g of $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$ [T] in each dm^3 of solution. or 26.1 g of $\text{Ba}(\text{NO}_3)_2$ [H] [O] in each dm^3 of solution.
[H]	acidified aqueous potassium manganate(VII)	$0.01 \text{ mol dm}^{-3} \text{ KMnO}_4$ $0.5 \text{ mol dm}^{-3} \text{ H}_2\text{SO}_4$	Mix equal volumes of $0.02 \text{ mol dm}^{-3} \text{ KMnO}_4$ and $1.0 \text{ mol dm}^{-3} \text{ H}_2\text{SO}_4$. To prepare $0.02 \text{ mol dm}^{-3} \text{ KMnO}_4$, dissolve 3.16 g of KMnO_4 [N] [O] [H] in each dm^3 of solution.
	1.0 mol dm^{-3} sodium carbonate	1.0 mol dm^{-3} sodium carbonate	Dissolve 286.1 g of $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ [H] in each dm^3 of solution.

4 The following materials and apparatus should be available.

hazard	label	identity	notes
[H]	limewater	saturated aqueous calcium hydroxide	(Hazards symbols given in this column refer to the raw materials.) Prepare fresh limewater by leaving distilled water to stand over solid calcium hydroxide, Ca(OH) ₂ , [H] for several days, shaking occasionally. Decant or filter the solution.
red and blue litmus papers, plain filter paper strips, aluminium foil for testing nitrate/nitrite, wooden splints, 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 carry out the experiments in Questions 1, 2 and 3** 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 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.

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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 **Questions 1, 2 and 3** 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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