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

CHEMISTRY **9701/31**

Paper 31 Practical Test **May/June 2007**

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.

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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 **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.

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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^3 burettes
2 × burette clamps
2 × stands
2 × funnels for filling burettes
1 × 250 cm^3 graduated (volumetric) flask, labelled **FA 3**
1 × 250 cm^3 conical flask
1 × 25 cm^3 measuring cylinder (a 25 cm^3 cylinder is specifically required, not a larger or smaller cylinder)
1 × 25 cm^3 pipette
1 × pipette filler (or equivalent safety device)
1 × white tile
1 × wash bottle containing distilled water
1 × weighing bottle
1 × plastic cup (preferably foamed plastic or expanded polystyrene) to hold at least 100 cm^3
1 × 250 cm^3 beaker (to support the plastic cup)
1 × 50 cm^3 measuring cylinder
1 × –10 °C to 110 °C by 1 °C thermometer
access to a balance weighing to 0.1 g or better
2 × 100 cm^3 beakers
2 × stirring rods
2 × test-tubes
5 × boiling-tubes
1 × test-tube rack
1 × test-tube holder
1 × Bunsen burner
1 × tripod and gauze
1 × heat proof mat
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 (Hazards given in this column are for the raw materials.)
[H]	**FA 1**	150 cm^3	3.40 g dm^{-3} anhydrous Na_2CO_3	aqueous solution of anhydrous sodium carbonate, Na_2CO_3 **[H]**, 3.40 g dm^{-3}
[H]	**FA 2**	50 cm^3	0.50 mol dm^{-3} HCl	Prepare this solution by diluting 45 cm^3 of concentrated acid **[C]** (35% w/w; approximately 11 mol dm^{-3}) to 1 dm^3. *Check and adjust the concentration of the acid in the following way.* • *Pipette a total of 50.0 cm^3 of* **FA 2** *into a 250 cm^3 graduated flask and make up to 250 cm^3 with distilled water.* • *Pipette 25.0 cm^3 of* **FA 1** *into a conical flask and add a few drops of methyl orange indicator.* • *Titrate* **FA 1** *against the* <u>*diluted*</u> <u>**FA 2**</u>*. The titre should be in the range 15.5–16.5 cm^3.* • *Calculate and carry out any necessary adjustment to the* <u>*concentration of hydrochloric acid in*</u> <u>**FA 2**</u>**.**
	methyl orange indicator	10 cm^3	methyl orange indicator	(pH range 2.9 to 4.6) Use commercially produced solution or prepare from solid by dissolving 0.4 g of solid indicator in 200 cm^3 of ethanol **[F]** and making up to 1 dm^3 with distilled water. Indicator may be made available in communal dropping bottles.
[H]	**FA 4**	10 g	anhydrous sodium carbonate, Na_2CO_3	
[H]	**FA 5**	120 cm^3	2.0 mol dm^{-3} HCl	Prepare this solution by diluting 190 cm^3 of concentrated acid **[C]** (35% w/w; approximately 11 mol dm^{-3}) to 1 dm^3.
[H]	**FA 6**	2 g	solid zinc carbonate (basic)	Different formulae may be offered for the "basic carbonate" the most common being $[ZnCO_3]_2[Zn(OH)_2]_3$. Any combination of carbonate, hydroxide and water is acceptable.
[T]	**FA 7**	2 g	solid copper(II) chloride, $CuCl_2.2H_2O$	This solid should be provided to candidates in a stoppered container as it is likely to absorb moisture from the air.

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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 (Hazards given in this column are for the raw materials.)
[C]	**dilute nitric acid**	2.0 mol dm^{-3} HNO_3	Dilute 128 cm^3 of concentrated (70% w/w) acid **[C][O]** to 1 dm^3.
[C]	**aqueous sodium hydroxide**	2.0 mol dm^{-3} 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.*
[H]	**aqueous ammonia**	2.0 mol dm^{-3} NH_3	Dilute 112 cm^3 of concentrated (35% w/w) ammonia **[C][N]** to 1 dm^3.

4 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 (Hazards given in this column are for the raw materials.)
[H]	**limewater**	saturated aqueous calcium hydroxide, $Ca(OH)_2$	Prepare fresh limewater by leaving distilled water to stand over solid calcium hydroxide **[H]** for several days, shaking occasionally. Decant or filter the solution.
[T][N]	**aqueous potassium dichromate(VI)**	0.1 mol dm^{-3} $K_2Cr_2O_7$	Dissolve 29.5 g of $K_2Cr_2O_7$ **[T][N]** in each dm^3 of solution which should contain about 10% dilute sulphuric acid **[H]**. *The use of plastic gloves may be considered to prevent contact with skin.*
		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	

Responsibilities of the Supervisor during the Examination

1 The Supervisor, or other competent chemist **must 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 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.

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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 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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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 index 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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General Certificate of Education Advanced Subsidiary Level and Advanced Level

CHEMISTRY **9701/32**

Paper 32 Practical Test **May/June 2007**

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Supervisors are asked to carry out any confirmatory tests given on pages 4 and 5 to ensure the materials supplied are appropriate.

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4 Identity of materials

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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^3 burettes
2 × funnels for filling burettes
2 × burette clamps
2 × stands
1 × 250 cm^3 graduated (volumetric) flask, labelled **FB 3**
1 × 250 cm^3 conical flask
2 × 25 cm^3 pipette
1 × pipette filler
1 × measuring cylinder to measure 10 cm^3
1 × white tile
1 × wash bottle containing distilled water
1 × plastic cup (preferably foamed plastic or expanded polystyrene) to hold at least 100 cm^3
1 × 250 cm^3 beaker (to support the plastic cup)
1 × weighing bottle to hold 15 g
1 × –10 °C to 110 °C by 1 °C thermometer
access to a balance weighing to 0.1 g or better
12 × test-tubes
1 × boiling-tube
1 × test-tube rack
1 × test-tube holder
2 × filter funnels (these may be the same as those used for filling burettes)
4 × filter papers
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 (Hazards given in this column are for the raw materials.)
[H]	**FB 1**	100 cm^3	0.41 mol dm^{-3} ammonium iron(II) sulphate	Dissolve 160.0 g of $(NH_4)_2SO_4.FeSO_4.6H_2O$ in 250 cm^3 of 1.0 mol dm^{-3} H_2SO_4 **[H]**, then make the solution up to 1 dm^3 with distilled water.
[H]	**FB 2**	150 cm^3	0.0120 mol dm^{-3} potassium manganate(VII)	Dissolve 1.90 g of $KMnO_4$ **[O] [H]** in each dm^3 of solution.
[H]	**1 mol dm^{-3} H_2SO_4**	100 cm^3	1.0 mol dm^{-3} sulphuric acid, H_2SO_4	Cautiously pour 55 cm^3 of concentrated (98%) sulphuric 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.*
Check on the concentrations of FB 1 and FB 2 *Use a pipette or measuring cylinder to place 5 cm^3 of **FB 1** in a conical flask. Add 10 cm^3 of 1 mol dm^{-3} sulphuric acid and titrate with **FB 2** until the first permanent pink colour is obtained.* *Adjust the concentration of either solution to obtain a titre in the range 33 – 35 cm^3.*				
[H]	**FB 4**	120 cm^3	0.8 mol dm^{-3} citric acid	Dissolve 168 g of 2-hydroxypropane-1,2,3-tricarboxylic acid-1-water (citric acid) **[H]** in each dm^3 of solution.
	FB 5	25 g	solid sodium hydrogencarbonate, $NaHCO_3$	
[C]	**FB 6**	20 cm^3	0.1 mol dm^{-3} iron(III) chloride	Dissolve 27.0 g of $FeCl_3.6H_2O$ **[C]** in each dm^3 of solution. *Use laboratory grade or better, **not** technical grade.*
[T] [H]	**FB 7**	20 cm^3	contains chromium chloride **and** sodium (or potassium) iodide	Dissolve 10.0 g of $CrCl_3.6H_2O$ **[T] [H] and** 15.0 g of NaI in each dm^3 of solution. 17.0 g of potassium iodide, KI, can be used in place of sodium iodide.
[T] [N]	**FB 8**	20 cm^3	0.1 mol dm^{-3} cobalt(II) sulphate	Dissolve 28.0 g of $CoSO_4.7H_2O$ **[T] [N]** in each dm^3 of solution.
[T] **[T]**	**0.1 mol dm^{-3} barium chloride [or barium nitrate]**	10 cm^3	0.1 mol dm^{-3} barium chloride [or 0.1 mol dm^{-3} barium nitrate]	Dissolve 24.4 g of $BaCl_2.2H_2O$ **[T]** in each dm^3 of solution. [Or dissolve 26.1 g of $Ba(NO_3)_2$ **[T] [O]** in each dm^3 of solution.]
[C] [N]	**0.05 mol dm^{-3} silver nitrate**	10 cm^3	0.05 mol dm^{-3} silver nitrate	Dissolve 8.5 g of $AgNO_3$ **[C] [N]** in each dm^3 of solution.

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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 (Hazard symbols refer to the raw materials.)
[C]	**dilute nitric acid**	2.0 mol dm^{-3} HNO_3	Dilute 128 cm^3 of concentrated (70% w/w) acid **[C] [O]** to 1 dm^3.
[H]	**dilute hydrochloric acid**	2.0 mol dm^{-3} HCl	Dilute 172 cm^3 of concentrated (35% w/w; approximately 11 mol dm^{-3}) acid **[C]** to 1 dm^3.
[C]	**aqueous sodium hydroxide**	2.0 mol dm^{-3} 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.*
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