



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

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**PHYSICAL SCIENCE**

**8780/04**

Paper 4 Advanced Practical Skills

**October/November 2012**

**CONFIDENTIAL INSTRUCTIONS**

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

**No access to the Question Paper is permitted in advance of the examination.**

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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

by phone: +44 1223 553554

by fax: +44 1223 553558

stating the Centre number, the nature of the query and the syllabus and paper number.

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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 handled with caution. Only those tests described in the Question Paper should be attempted. Pipette fillers and safety goggles should be used where necessary.

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.

The following hazard codes are used where relevant.

<b>[C]</b> corrosive substance	<b>[F]</b> highly flammable substance
<b>[H]</b> harmful or irritating substance	<b>[O]</b> oxidising substance
<b>[T]</b> toxic substance	<b>[N]</b> dangerous for the environment

The attention of Centres 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 These instructions detail the apparatus required for the experiments in the Question Paper. **Access to the Question Paper is NOT permitted in advance of the examination.** The contents of these Confidential Instructions must not be revealed either directly or indirectly to the candidates.
- 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.  
If the concentrations differ slightly from those specified, the Examiners will make the necessary allowance. They should be informed in the Supervisor's Report of the exact concentrations.
- 3 **Labelling of materials**  
Materials must be labelled as specified in these Confidential Instructions. It may be required for some materials to be labelled but **without** the identities being included on the label.  
It should be noted that descriptions of materials given in the Question Paper may not correspond with the specifications in these Instructions. **The candidates must assume the descriptions given in the Question Paper.**
- 4 **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.
- 5 **Number of sets of apparatus**  
The minimum number of sets of apparatus provided for each experiment is half the number of candidates taking the examination. There should, in addition, be a few spare sets of apparatus available in case problems arise during the examination.

## The Examination

### 1 Organisation of the Examination

Essential Information relating to the conduct and invigilation of the Practical Examination is given in the Handbook for Centres.

Candidates should be allowed access to the apparatus for each experiment for 45 minutes only. After spending 45 minutes on one experiment, candidates should change over to the other experiment. The order in which a candidate attempts the two experiments is immaterial.

### 2 Assistance to Candidates

Supervisors should make the following announcement at the start of the examination:

'The Examiners do not want you to waste time when you are unable to do any experiment. Any candidate who is unable to get results with an experiment may ask for help. The extent of this help will be reported to the Examiners, who may make a deduction of marks.'

Assistance should only be given when it is asked for by a candidate, or as directed in the Notes sections of these Instructions, or where apparatus is seen to have developed a fault. Assistance should be restricted to enabling candidates to make observations and measurements. Observations and measurements must not be made for candidates, and no help should be given with data analysis or evaluation.

All assistance given to candidates must be reported on the Supervisor's Report Form.

### 3 Colour blindness

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. Reporting such cases with the scripts removes the need for a 'Special Consideration' application.

Candidates who are red/green colour blind do not generally have significant difficulty.

### 4 Faulty apparatus

In cases of faulty apparatus that prevent the required measurements from being taken, the Supervisor may allow extra time to give the candidate a fair opportunity to perform the experiment as if the fault had not been present.

### 5 Supervisor's Results

If asked to do so in the Confidential Instructions, the Supervisor, or other competent Physical Scientist, should carry out the required experimental work **out of sight of the candidates**. Access to the Question Paper is NOT permitted in advance of the examination.

Supervisor's Results are required for each session and each laboratory used in that session, and each set of solutions supplied. The Question Paper cover requests candidates 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 Supervisor's Results as the candidate's work cannot be assessed accurately without such information.

## 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 Results if required by the Confidential Instructions,
- 3 the Supervisor's Report, including details of any difficulties experienced by candidates (see pages 7 and 8),
- 4 the Attendance Register,
- 5 a plan of work benches, giving details by candidate number of the places occupied by the candidates for each experiment and session.

## Instructions for Preparing Apparatus and Materials

In addition to the fittings ordinarily contained in a Science laboratory, the apparatus and materials specified below will be necessary.

### Question 1

#### Apparatus required (per set of apparatus unless otherwise specified)

- 105 cm of 28 swg constantan wire (see note 2)
- 1 metre rule (see note 2)
- d.c. power supply of approximately 6V (transformer or low internal resistance battery, **not** dry cells, see note 3)
- switch labelled **S** (this may be an integral part of the power supply), see note 4
- $3.3\ \Omega$  resistor rated at a minimum of 4W, labelled **P** (see notes 5 and 6)
- $68\ \Omega$  resistor rated at a minimum of 2W, labelled **68  $\Omega$**  (see note 6)
- milliammeter (0–100 mA) with a minimum precision of  $\pm 2$  mA
- 1 long (80 cm or more) and 1 short (20 cm or less) connecting lead, each with a crocodile clip attached at one end
- 1 connecting lead of length at least 100 cm, with a crocodile clip labelled **C** attached at one end
- 3 more connecting leads of any length

#### Notes

- 1 All apparatus including leads should be carefully checked before the examination to ensure they are in good working order. Spares should be held in the care of the Supervisor and provided to candidates on request without penalty.
- 2 The constantan wire should be taped to the metre ruler at the 3 cm and 97 cm points only. Care should be taken so that the wire is as straight as possible. There should be a couple of centimetres excess at either end of the metre rule. Label this set-up 'resistance wire'. Constantan wire is also known as eureka wire.
- 3 If the power supply has a variable output, the voltage setting should be set by the Supervisor and fixed (e.g. taped).
- 4 If a separate switch is used, this should be connected to the power supply by a short lead.
- 5 The value of resistor **P** should be covered.
- 6 Both resistors should be held in a component holder with terminals.
- 7 The connecting leads should have stackable plugs so that candidates can make good contacts between different components arranged in series or parallel.
- 8 The Supervisor may be asked by a candidate for assistance in setting up the circuit. The Supervisor should immediately correct the circuit. A note should be made on the front of the candidate's script and the names of such candidates included on the Supervisor's Report.

#### Action at changeover

Disconnect the circuit and leave the apparatus for the next candidate.

If batteries are used for the power supply, check that they are not run down.

#### Information required by the Examiners

Sample set of results, clearly marked 'Supervisor's Results' obtained out of sight of the candidates. Names of candidates requiring help to set up the circuit should be included on the Supervisor's Report.

**Question 2**

**Under no circumstances must the identity of P, or the concentration of the hydrochloric acid, be divulged to candidates.**

**Apparatus required (per set of apparatus unless otherwise specified)**

- 1 × 50cm<sup>3</sup> burette (per candidate)
- 1 × burette clamp and stand
- 1 × funnel for filling burette
- 1 × 250cm<sup>3</sup> conical flask (per candidate)
- 1 × 25cm<sup>3</sup> pipette (per candidate)
- 1 × pipette filler
- 1 × white tile
- 1 × wash-bottle containing distilled water
- 2 × test-tubes (per candidate)
- 1 × test-tube rack
- 3 × teat/squeeze/dropping pipettes (per candidate)
- 2 × glass beaker of any size (per candidate)
- paper towels

**Chemicals**

See table page 6.

**Notes**

- 1 Spare materials and equipment should be available and can be provided without penalty.  
**Candidates should be made aware of this.**
- 2 Pipette fillers (or equivalent safety devices), safety goggles and disposable plastic gloves should be used where necessary.

**Information required by Examiners**

Sample set of numerical results for part (a), clearly marked 'Supervisor's Results', obtained out of sight of the candidates.

## Chemicals Required for Question 2

## Particular requirements

hazard	label	per candidate	identity	notes (Hazard symbols given in this column are for the raw materials.)
[C]	<b>X</b> dilute hydrochloric acid	150cm <sup>3</sup>	must be between 0.11 and 0.12 mol dm <sup>-3</sup> HCl	Candidates must not know the concentration of this solution.
[H]	<b>Y</b> 0.100 mol dm <sup>-3</sup> sodium hydroxide	150cm <sup>3</sup>	0.100 mol dm <sup>-3</sup> sodium hydroxide	Dissolve 4.00g of freshly purchased NaOH [C] in each dm <sup>3</sup> of solution. Issue this solution in a stoppered container or beaker covered with 'Clingfilm' or 'Gladwrap' to prevent absorption of carbon dioxide.
[F]	<b>phenolphthalein indicator</b>	10cm <sup>3</sup>	phenolphthalein indicator	Dissolve 1.0g of the solid indicator [H] in 600cm <sup>3</sup> of ethanol (IMS) [F] and make up to 1 dm <sup>3</sup> with distilled water. Alternatively use commercially produced indicator solution.
[H]	<b>P</b>	10cm <sup>3</sup>	Approx 0.2 mol dm <sup>-3</sup> zinc nitrate	Dissolve 60g of freshly purchased hydrated zinc nitrate in each 1 dm <sup>3</sup> of distilled water.

The standard bench reagents 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 given in this column are for the raw materials.)
[C]	<b>2.0 mol dm<sup>-3</sup> aqueous sodium hydroxide</b>	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</b> – the process of solution is exothermic and any concentrated solution is very corrosive.
[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% w/w) ammonia [C] [N] to 1 dm <sup>3</sup> .
	<b>distilled / deionised water</b>		Each candidate should be provided with a wash bottle containing fresh distilled or deionised water

**This form should be completed and sent to the Examiner with the scripts.**

### **SUPERVISOR'S REPORT FORM**

The Supervisor's Report should give full details of:

- (a)** any help given to a candidate (including the nature of the help given and the name and candidate number of the candidate),
- (b)** any cases of faulty apparatus (including the nature of the problem, the action taken to rectify it, any additional time allowed, and the name and candidate number of the candidate),
- (c)** assistance provided in the case of colour blindness,
- (d)** any other difficulties experienced by candidates, or any other information that is likely to assist the Examiner, especially if this information cannot be discovered in the scripts.

Cases of individual hardship, such as illness, bereavement or disability, should be reported direct to CIE on the normal Special Consideration form.

#### **Supervisor's Report**



**Information required by Examiners**

Sample set of numerical results, clearly marked 'Supervisor's Results'. These may be recorded on a spare copy of the Question Paper.

**A plan of work benches for each session/laboratory.**

**Declaration** (to be signed by the Supervisor)

The preparation of this practical examination has been carried out so as to maintain fully the security of the examination.

Signed .....

Name (in block capitals) .....

Centre Number .....

Centre Name .....

If scripts are required by CIE to be despatched in more than one envelope, it is essential that a copy of the relevant Supervisor's report, Supervisor's results and the appropriate seating plan(s) are sent inside **each** envelope.

