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**PHYSICAL SCIENCE**

**8780/04**

Paper 4 Advanced Practical Skills

**October/November 2016**

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 pages 7 and 8 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 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 treated 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	<b>MH</b> = moderate hazard
<b>HH</b> = health hazard	<b>T</b> = acutely toxic
<b>F</b> = flammable	<b>O</b> = oxidising
<b>N</b> = hazardous to the aquatic 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 prevents 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 barcode 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.

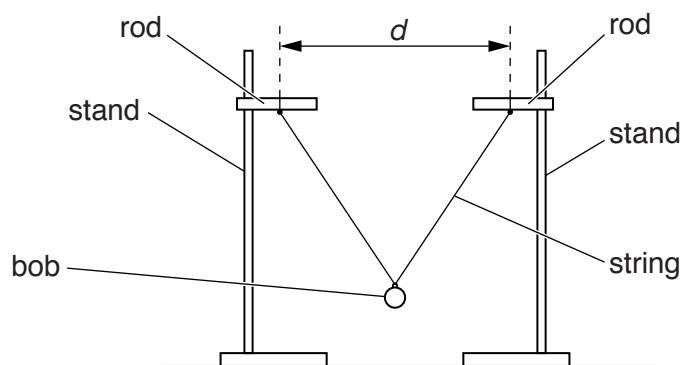
## Instructions for Preparing Apparatus and Materials

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

### Question 1

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

- 1 × piece of string of length 1.20 m
- 1 × pendulum bob of mass between 30 g and 100 g (see note 1)
- 2 × stands of height at least 60 cm
- 2 × bosses
- 2 × rods of diameter 1 cm and length 10 cm (see note 2)
- 1 × metre rule with a millimetre scale
- 1 × stopwatch measuring to 0.1 s or better
- Clear adhesive tape (see note 3)



**Fig. 1.1**

#### Notes

- 1 A bob with a hook is suitable. The bob should be hung on the string. A bob with a hole through its centre is also suitable. The string should be passed through the hole.
- 2 Each rod should be held horizontally in a boss attached to a stand. The rods should be held in the bosses so that they are the same height above the bench.
- 3 Attach the string to the rods with a suitable knot at each end and secure the string to the rods with clear adhesive tape. The string should be clearly visible through the adhesive tape.
- 4 The pendulum bob must be able to swing with small oscillations between the clamps without touching the bench or the clamps when the distance  $d$  is 25 cm.

#### Action at changeover

Make sure that the apparatus is still correctly set up as shown in Fig. 1.1 and adjust the position of the stands so that the distance  $d$  is less than 30 cm.

Ensure the apparatus is set up so that the student faces the elevation shown on Fig. 1.1.

## Question 2

**Under no circumstances must the mass of the sodium carbonate in the solution or the concentration of the solution be divulged to candidates.**

### Apparatus required for each candidate

- 3 × 250 cm<sup>3</sup> conical flasks
- 1 × 50 cm<sup>3</sup> burette
- 1 × funnel
- 1 × stand
- 1 × burette clamp
- 1 × white tile
- 1 × 25 cm<sup>3</sup> pipette
- 1 × pipette filler
- 1 × 100 cm<sup>3</sup> measuring cylinder
- 1 × 25 cm<sup>3</sup> measuring cylinder
- 1 × 250 cm<sup>3</sup> beaker labelled **Q**
- 1 × glass stirring rod
- paper towels
- 1 × wash bottle containing distilled/deionised water

### Chemicals

See table

### Notes

- 1 Spare materials and equipment should be available and can be provided without penalty. **Candidates should be made aware of this.**
- 2 Safety goggles and disposable plastic gloves should be used where necessary.
- 3 If three 250 cm<sup>3</sup> conical flasks are not available for each candidate, candidates may be provided with one 250 cm<sup>3</sup> conical flask **and** the means to wash it out between titrations.

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## 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>1.00 mol dm<sup>-3</sup> sulfuric acid</b>	100 cm <sup>3</sup> in a suitable container	sulfuric acid 1.00 mol dm <sup>-3</sup>	This solution must be made up with the concentration as near to 1.00 mol dm <sup>-3</sup> as possible. Cautiously pour 55 cm <sup>3</sup> of concentrated (98%) sulfuric 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 – concentrated H<sub>2</sub>SO<sub>4</sub> is very corrosive.</b> <b>THE CONCENTRATED ACID MUST BE ADDED TO THE WATER AND NOT THE OTHER WAY ROUND.</b>
[C]	<b>0.50 mol dm<sup>-3</sup> sodium hydroxide</b>	100 cm <sup>3</sup> of solution in a suitable container	0.50 mol dm <sup>-3</sup> aqueous sodium hydroxide	This solution must be made up with the concentration as near to 0.50 mol dm <sup>-3</sup> as possible.
[MH]	<b>sodium carbonate solution</b>	50 cm <sup>3</sup> of solution in a suitable container	sodium carbonate solution containing 40.0 g dm <sup>-3</sup>	The solution must contain 40.0 g of anhydrous sodium carbonate [MH] in each litre of solution. <b>Under no circumstances must the mass of the sodium carbonate in the solution or the concentration of the solution be divulged to candidates.</b>
[F][MH] [HH]	<b>methyl orange indicator</b>	a few drops for each titration	methyl orange	This can be supplied from communal dropping bottles or in suitable containers and droppers provided. Approximately 2 cm <sup>3</sup> is required for each candidate. Use commercially produced solution or dissolve 0.4 g of solid indicator [T] in 200 cm <sup>3</sup> of ethanol (IMS) [F][MH][HH] and make up to 1 dm <sup>3</sup> with distilled 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**

1. A sample set of numerical results, clearly marked ‘Supervisor’s Results’. These may be recorded on a spare copy of the Question Paper.
2. 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.

