



## Preparing apparatus

These Instructions detail the apparatus required for the experiments in the Question Paper. It is essential that absolute confidentiality is maintained in advance of the examination: the contents of these Instructions must not be revealed either directly or indirectly to candidates.

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

If you have problems or queries regarding these Instructions, please contact Cambridge:

by e-mail: info@cie.org.uk,  
or by telephone: +44 1223 553554,  
or by fax: +44 1223 553558,

stating the nature of the query and quoting the syllabus and paper numbers (9702/36).

It is assumed that the ordinary apparatus of a Physics laboratory will be available.

## Number of sets of apparatus

The number of sets of apparatus provided for each experiment should be  $\frac{1}{2}N$ , where  $N$  is 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.

## Organisation of the examination

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

## Assistance to Candidates

Candidates should be informed that, if they find themselves in real difficulty, they may ask the Supervisor for practical assistance, but that the extent of this assistance will be reported to the Examiner, 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.

## Faulty apparatus

In cases of faulty apparatus (not arising from a candidate's mishandling) that prevent the required measurements 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. The candidate should use a spare copy of the Question Paper when the fault has been rectified or when working with a second set of apparatus.

## Supervisor's Report

The Supervisor should complete the Supervisor's Report Form on pages 7 and 8 and enclose it in the envelope containing the answers of the candidates. If more than one envelope is used, a copy of the report must be enclosed in each envelope.

**Question 1****Apparatus requirements (per set of apparatus unless otherwise specified)**

3V d.c. power supply (e.g. two 1.5V cells).

Switch.

Resistors with values 4.7 k $\Omega$ , 3.3 k $\Omega$ , 2.2 k $\Omega$ , 1.5 k $\Omega$ , 1.0 k $\Omega$ , 0.68 k $\Omega$ , 0.47 k $\Omega$ , 0.33 k $\Omega$  and 0.22 k $\Omega$  each labelled with its value in k $\Omega$  to 2 significant figures, e.g. '0.68 k $\Omega$ ' and '3.3 k $\Omega$ '. See Note 1.

Component holder with crocodile clips and terminals.

680  $\Omega$  resistor labelled A with its value of resistance concealed. It should be fitted with terminals to allow connection in a circuit. See Note 1.

330  $\Omega$  resistor labelled B with its value of resistance concealed. It should be fitted with terminals to allow connection in a circuit. See Note 1.

105 cm length of bare resistance wire. See Note 2 and Note 3.

Metre rule with a millimetre scale. See Note 3.

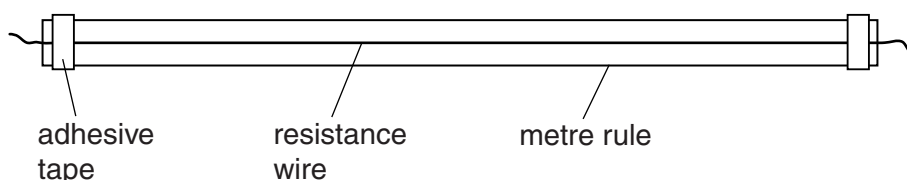
Two crocodile clips.

D.C. voltmeter with a range of 0–2V. A multimeter set to this range is suitable provided the range switch is fixed and any unused terminals are covered.

Twelve connecting leads of approximate length 60 cm. One of the leads should have an end suitable for making contact on the resistance wire, and this end should be labelled M.

**Notes**

- All the resistors should be rated at 0.25W, with a maximum tolerance of 5%.
- The resistance wire should have an approximate resistance of 15  $\Omega$  m<sup>-1</sup> (e.g. 34 swg constantan, 36 swg constantan, 30 swg nichrome or 32 swg nichrome).
- The resistance wire should be attached to the metre rule using adhesive tape as shown in Fig. 1.1.



**Fig. 1.1**

- The apparatus should be laid out on the bench. If it is to be used by another candidate, then it should be restored to its original state.

**Information required by Examiners**

Sample set of numerical results, clearly labelled "Supervisor's Results" and obtained out of sight of the candidates.

**Question 2****Apparatus requirements (per set of apparatus unless otherwise specified)**

Empty, lightweight plastic bottle with approximately constant cross-section and approximate height 200 mm. See Note 1.

Flat-headed nail of approximate length 6 cm and approximate diameter 3 mm. See Note 1.

Stopwatch reading to 0.1 s or better.

Stand, boss and clamp.

Tray of sufficient size to hold the base of the stand.

Container with enough water to fill the bottle, and suitable for pouring water into the bottle.

100 g slotted mass.

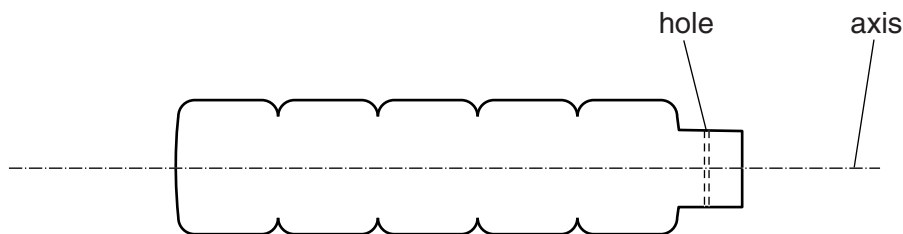
String of approximate length 50 cm.

Paper towels.

30 cm ruler with a millimetre scale.

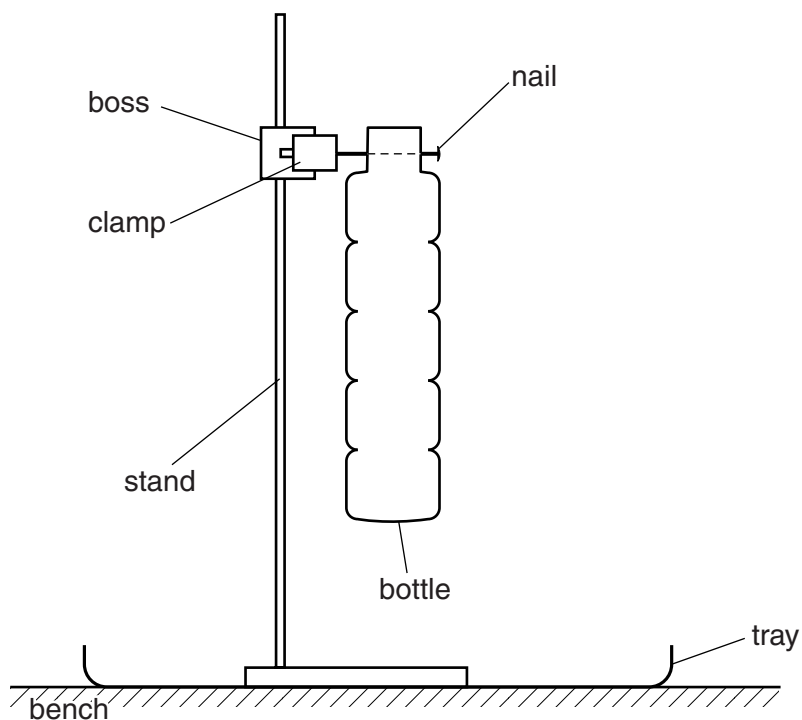
**Notes**

- 1 Remove the cap and discard it. Drill a hole through the neck of the bottle. The diameter of the hole should be slightly greater than the diameter of the nail. The hole should pass through the axis of the bottle and should be perpendicular to the axis of the bottle, as shown in Fig. 2.1.



**Fig. 2.1**

- 2 The **candidate** will set up the apparatus as shown in Fig. 2.2. Ensure that the bottle can swing freely with this arrangement.



**Fig. 2.2**

- 3 The apparatus should be disassembled and laid out on the bench. If the apparatus is to be used by another candidate, then it should be returned to its original state.

### Information required by Examiners

Sample set of numerical results, clearly labelled "Supervisor's Results" and obtained out of sight of the candidates.

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**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) any accidents that occurred during the examination;
- (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 Cambridge on the normal Special Consideration form.

#### **Information required by Examiners**

For each question, please enclose a sample set of numerical results, obtained out of sight of the candidates and clearly labelled "Supervisor's Results".

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



**Supervisor's Report (continued)**

**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 .....

Centre number .....

Name of Centre .....

