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**PHYSICS**

**9702/31**

Paper 3 Advanced Practical Skills 1

**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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If you have any problems or queries regarding these Instructions, please contact CIE  
by e-mail: [info@cie.org.uk](mailto: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.

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This document consists of **8** printed pages.

## 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 CIE:

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 (9702/31).

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)**

Two stands each of height at least 60 cm.

Two G-clamps suitable for attaching the base of a stand to the bench.

String. See Note 1.

Small metal ring e.g. key ring. See Note 1.

Two expendable springs each with approximate outside diameter 15 mm, approximate coiled length 20 mm and approximate spring constant  $25 \text{ N m}^{-1}$  (e.g. Philip Harris product code B8G87194). See Note 1.

Two bulldog clips. See Note 2.

100 g mass hanger.

Three 100 g slotted masses.

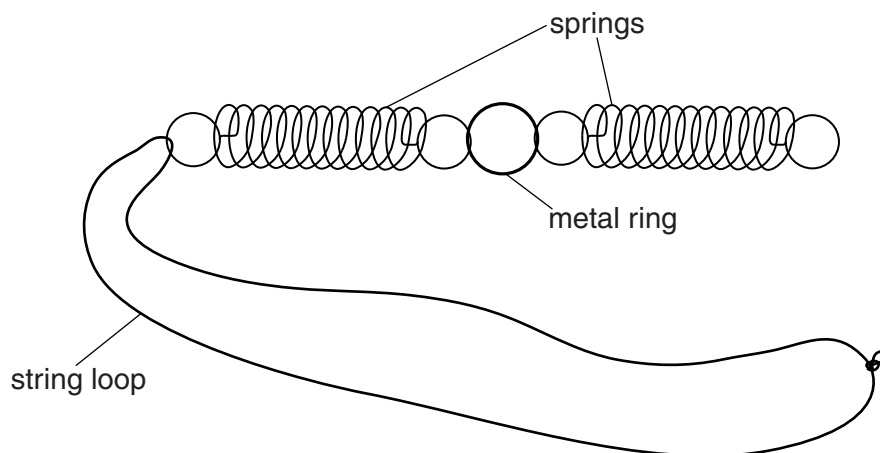
Metre rule with a millimetre scale.

180° protractor with 1° divisions.

Stopwatch reading to 0.01 s.

## Notes

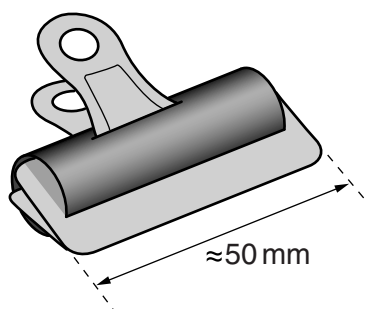
- 1 Assemble the springs, string and metal ring as shown in Fig. 1.1.



**Fig. 1.1**

The string loop should have a circumference of 45 cm and be attached to one of the springs as shown.

- 2 A suitable bulldog clip as shown in Fig. 1.2 should have a gripping edge of approximate length 50 mm.



**Fig. 1.2**

- 3 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 by the Supervisor, who should be a teacher of Physics or other competent physicist.

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

1.5V dry cell with terminals.

Digital ammeter set to the range 0 – 200 mA reading to the nearest 0.1 mA or better. If a digital multimeter is used, the range should be fixed and any unused terminals should be covered.

Digital voltmeter set to the range 0 – 20 V reading to the nearest 0.01 V or better. If a digital multimeter is used, the range should be fixed and any unused terminals should be covered.

Rheostat with maximum resistance in the range 8 – 20  $\Omega$ . See Note 1.

Wooden strip of approximate length 50 cm and approximate cross-section 35 mm  $\times$  5 mm. See Note 2.

30 cm of 34 swg bare constantan wire. See Note 2.

30 cm of 36 swg bare constantan wire. See Note 2.

30 cm of 38 swg bare constantan wire. See Note 2.

Four nails of approximate diameter 1.5 mm and approximate length 20 mm. See Note 2.

Seven connecting leads.

Two crocodile clips.

Small container for the crocodile clips.

Switch.

Micrometer screw gauge (shared between at most two candidates).

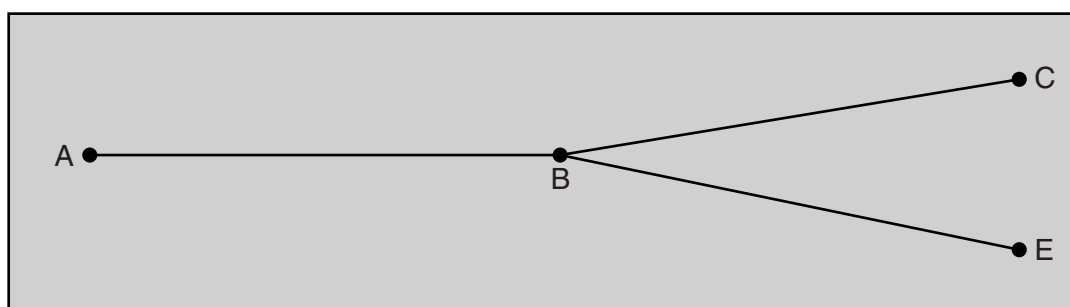
## Notes

- 1 The rheostat is to be used to provide a variable resistance. Any unused terminals should be covered.
- 2 The wooden strip, wires and nails should be assembled as shown in Fig. 2.1.  
The nails should be hammered into the wooden strip so that:

AB = 20 cm of 38 swg constantan wire  
 BC = 20 cm of 36 swg constantan wire  
 BE = 20 cm of 34 swg constantan wire.

The wires should be soldered to the nails.

It should be possible to attach crocodile clips to each of the four nails.  
 The labels A, B, C and E should be written on the wooden strip.



**Fig. 2.1** (not to scale)

If constantan wire is not available, use nichrome wire as follows:

AB = 20 cm of 34 swg nichrome wire  
 BC = 20 cm of 30 swg nichrome wire  
 BE = 20 cm of 28 swg nichrome wire.

- 3 The apparatus should be laid out on the bench. If the apparatus 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 by the Supervisor, who should be a teacher of Physics or other competent physicist.

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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 CIE 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 .....

