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**PHYSICS**

**9702/36**

Paper 3 Advanced Practical Skills 2

**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 (9702/36).

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)**

Metre rule with a millimetre scale. See Note 1.

105 cm length of 32 swg constantan resistance wire. See Note 1 and Note 2.

Adhesive tape. See Note 1.

1.5V d.c. power supply.

Switch.

15  $\Omega$  resistor with a power rating of at least 0.25W (e.g. RS Components product code 477-7574). The resistor should be provided with terminals, and should be labelled P.

1 k $\Omega$  resistor with a power rating of at least 0.25W (e.g. RS Components product code 132-494). The resistor should be provided with terminals, and should be labelled Q.

Digital microammeter with a range of 0 to 2000  $\mu$ A. See Note 3.

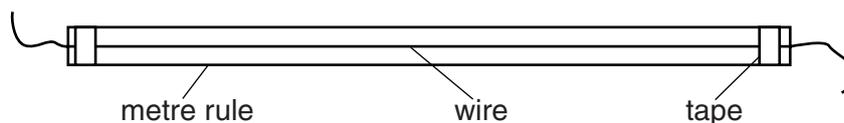
Seven connecting leads. One of the leads should have a length of at least 75 cm.

Three crocodile clips.

Small container for the crocodile clips (e.g. a plastic petri dish).

**Notes**

- 1 The resistance wire should be fixed to the metre rule with tape. There should be 2.5 cm of free wire at each end, as shown in Fig. 1.1.



**Fig. 1.1**

- 2 If 32 swg constantan wire is not available, other resistance wire with approximate resistance  $10 \Omega \text{m}^{-1}$  may be used.
- 3 If a multimeter is used, it should be fixed on this range and any unused terminals covered. The range should be clearly labelled.  
If a 0 – 2000  $\mu$ A microammeter is not available, a meter with range 0 – 20 mA reading to 0.01 mA could be used.
- 4 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**

1. 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.
2. The resistance of one metre of the resistance wire used.
3. The range and precision of the ammeter used.

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

Stand with two bosses and two clamps.

Metre rule with a millimetre scale.

Micrometer screw gauge shared between, at most, three candidates.

Glass sphere (e.g. a marble) of approximate diameter 18 mm. See Note 1.

Glass sphere (e.g. a marble) of approximate diameter 25 mm. See Note 1.

String. See Note 1.

Duct tape (cloth-reinforced adhesive tape). See Note 1.

Small container to hold the spheres (e.g. a plastic petri dish).

Sphere of adhesive putty (e.g. Blu-Tack) of approximate mass 5 g.

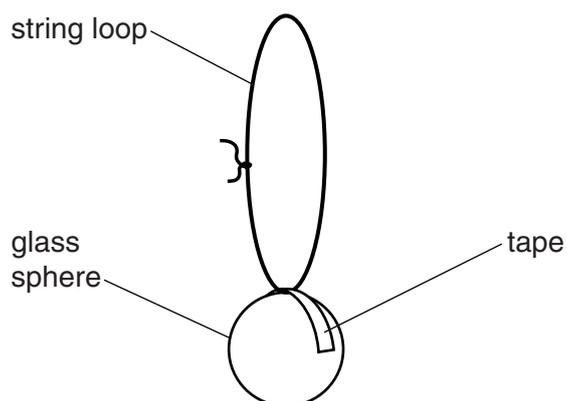
Two 250 ml beakers. One beaker should contain 250 ml of water.

Paper towels.

Triangular prism of approximate height between 1 and 3 cm, to act as a pivot.

**Notes**

- 1 Each glass sphere should have a string loop of circumference 16 cm attached to it using a narrow strip of duct tape, as shown in Fig. 2.1.

**Fig. 2.1**

Suitable strips of approximate length 50 mm and width 5 mm should be cut from the duct tape. This can be done by placing a length of duct tape on silicone release paper before cutting the strips using a sharp craft knife.

- 2 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, with the Blu-Tack gathered into a sphere.

**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".

For Question 1:

resistance of one metre of the resistance wire used = .....  $\Omega$

range and precision of the ammeter used: .....

#### **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 .....

