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**PHYSICS**

**9702/34**

Paper 3 Advanced Practical Skills 2

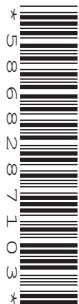
**October/November 2018**

**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 queries regarding these Confidential Instructions, please contact Cambridge stating the Centre number, the nature of the query and the syllabus number quoted above.

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This document consists of 7 printed pages and 1 blank page.

## Preparing apparatus

These Confidential 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 Confidential Instructions must not be revealed either directly or indirectly to candidates.

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

## 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 Confidential 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.

## 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. Any action taken must be reported on the Supervisor's Report.

## Supervisor's Report

The Supervisor should complete the Supervisor's Report 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)

D.C. power supply fixed at 6 V.

Switch labelled A. This switch must be separate from any switch on the power supply.

Two-way switch labelled S. The two positions should be labelled 1 and 2.

Connecting leads.

Component holder with terminals.

Digital voltmeter with a range of 0–20 V and reading to 0.01 V. A multimeter set to this range is suitable provided the range switch is fixed and any unused terminals are covered.

2200  $\mu\text{F}$  capacitor rated at 25 V (e.g. RS Components stock number 707-6672).

Three 1 k $\Omega$  resistors rated at 0.25 W (e.g. RS Components stock number 707-7666). One resistor should be labelled R and fitted with terminals.

Twenty-eight 10 k $\Omega$  resistors (e.g. RS Components stock number 707-7745). See Note 2.

Stopwatch reading to 0.1 s or better.

#### Notes

- Assemble the circuit shown in Fig. 1.1.  
Ensure that the capacitor, voltmeter and power supply are connected with the polarities shown.  
It must be possible for the candidate to make connections to points X and Y in the circuit. Points X and Y should be labelled.  
The circuit should be laid out as clearly as possible on the bench.

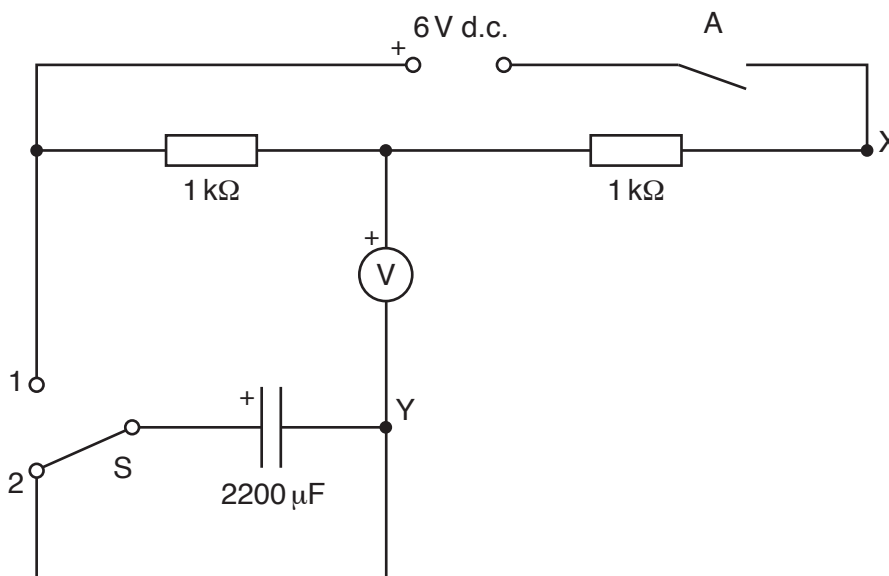


Fig. 1.1

- 2 The  $10\text{k}\Omega$  resistors should be separated into seven groups containing 7, 6, 5, 4, 3, 2 and 1. The resistors in each group should be soldered together in parallel. It should be possible to connect each group, in turn, into the component holder.
- 3 The groups of resistors, the component holder, the resistor R, **four** additional connecting leads and the stopwatch 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.

## Question 2

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

Flat wooden board of length 66.0 cm, approximate width 8 cm and approximate thickness 2 cm. See Note 1.

Three wooden strips each of length 62.0 cm and each with the **same** square cross-section of approximately 12 mm × 12 mm. See Note 1.

Two wooden blocks of approximate length 8 cm with a square cross-section of approximately 20 mm × 20 mm.

Glass or metal sphere of approximate diameter 25 mm (e.g. marble or steel ball).

Access to a micrometer screw gauge (shared between, at most, four candidates). See Note 2.

5 g of adhesive putty (e.g. Blu-Tack) formed into an approximately spherical shape.

Stopwatch reading to 0.1 s or better.

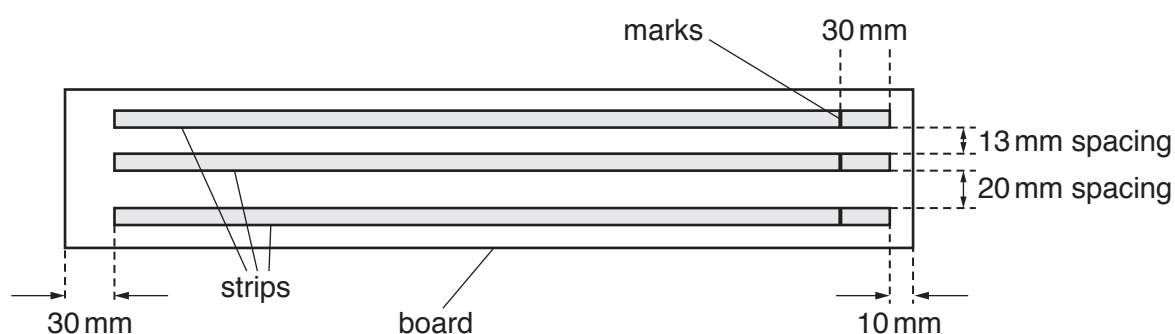
180° protractor with 1° divisions.

Metre rule with a millimetre scale.

### Notes

- 1 Fix the three wooden strips securely to the wooden board in the positions shown in Fig. 2.1. All three strips must be parallel to each other.

Use a fine marker pen to make marks on the strips as shown in Fig. 2.1.



**Fig. 2.1**

- 2 It must be possible to measure the diameter of the sphere with the micrometer.
- 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. The adhesive putty should be returned to an approximately spherical shape.

### 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**

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 directly 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 .....