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**PHYSICS**

**9702/31**

Paper 3 Advanced Practical Skills 1

**May/June 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 **8** printed pages.

### **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)

Two stands each of height at least 60 cm.

Two clamps.

Two bosses.

Expendable spring 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).

Two metre rules each with a millimetre scale. See Note 1.

$180^\circ$  protractor with  $1^\circ$  divisions.

String. See Note 1 and Note 3.

Mass. See Note 2.

Stopwatch reading to 0.1 s or better.

#### Notes

- 1 One of the metre rules should have a hole of approximate diameter 2 mm drilled centrally at the 99 cm mark as shown in Fig. 1.1.

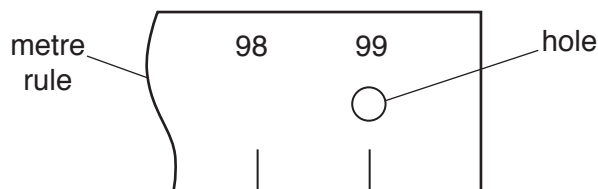


Fig. 1.1

A string loop with an approximate circumference of 20 cm should be tied through the hole in the metre rule.

- 2 The mass should be made from a mass hanger, slotted masses and modelling clay. It should have the **same** mass as the metre rule with string in Note 1. Label this mass M.
- 3 Another string loop with an approximate circumference of 20 cm should be tied through one of the loops of the spring as shown in Fig. 1.2.

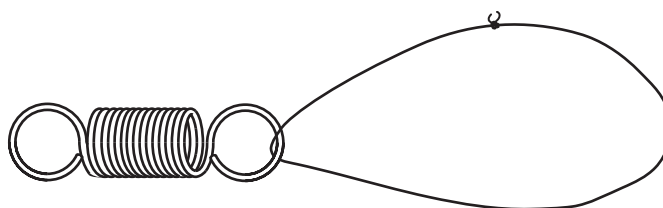


Fig. 1.2

- 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**

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)**

Adhesive tape (e.g. Sellotape).

Scissors.

Stand of height at least 60 cm.

Boss and clamp.

Split cork.

Strong bar magnet with approximate dimensions 7 cm × 1.5 cm × 1 cm. See Note 1 and Note 2.

Three steel paper clips each of approximate length 3 cm. See Note 1.

String of approximate diameter 2 mm and approximate length 70 cm. See Note 2.

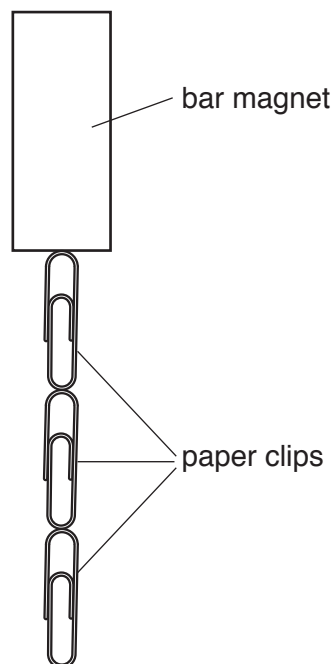
Aluminium plate of approximate dimensions 200 mm × 30 mm × 2 mm.

Metre rule with a millimetre scale.

Two strips of plain paper. See Note 3.

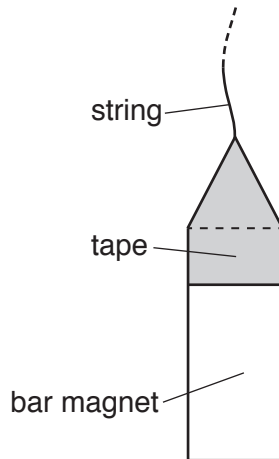
**Notes**

- 1 The magnet should be able to support the three disconnected steel paper clips, as shown in Fig. 2.1.



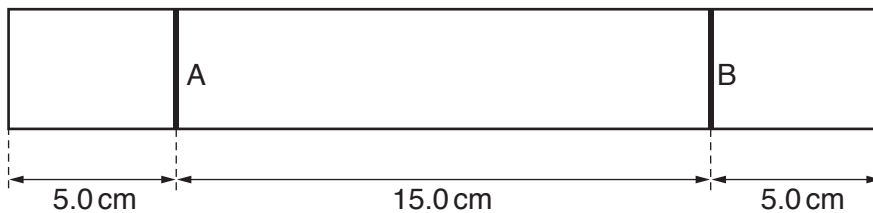
**Fig. 2.1**

- 2 Use adhesive tape to attach the string centrally to the bar magnet as shown in Fig. 2.2.



**Fig. 2.2**

- 3 Each strip of paper should have dimensions  $3.0\text{ cm} \times 25.0\text{ cm}$ . Two parallel lines should be drawn on each strip  $15.0\text{ cm}$  apart and labelled A and B, as shown in Fig. 2.3.



**Fig. 2.3**

Spare strips of paper should be available.

- 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. Two new paper strips should be provided. Any tape should be removed from the bench and the aluminium plate.

### 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 .....