



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
General Certificate of Education Ordinary Level

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**PHYSICS**

**5054/31**

Paper 3 Practical Test

**May/June 2012**

**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: international@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 **11** printed pages and **1** blank page.



## Instructions for preparing apparatus

These instructions detail the apparatus required for each experiment in this paper. No access is permitted to the Question Paper in advance of the examination session.

## Number of sets of apparatus

In addition to a few spare sets, the minimum number of sets of apparatus to be provided should be sufficient to enable candidates to spend 20 minutes with the apparatus for each of Questions 1, 2 and 3, and one hour with the apparatus for Question 4. The order in which candidates answer the questions will be determined by the Supervisor. Candidates may spend one hour circulating around Questions 1, 2 and 3, followed by an hour on Question 4, or vice versa.

It is assumed that candidates will supply their own calculator and geometrical instruments, such as a set square,  $0^\circ$  to  $180^\circ$  protractor, pair of compasses and 30 cm rule. Candidates should be advised in advance that they may, if they wish, use quartz wristwatches with stopwatch facilities, providing that such wristwatches afford the required precision.

## Instructions for the supervision of the examination

The Supervisor, who may be a Physics teacher, is responsible for the administration of the examination according to the procedures detailed in the Handbook for Centres. In all instances, a Physics teacher should be present. Preferably, this teacher should have been responsible for the preparation of the apparatus. Two invigilators must be present at all times: it is not acceptable for a teacher who has been responsible for preparing the candidates for this paper to be the sole Supervisor or Invigilator.

Supervisors may make the following announcement at the start of the examination.

'The Examiners do not want you to waste time when you are unable to do any experiment. Any candidate who is unable to get results with an experiment may ask for help. The extent of this help will be reported to the Examiners, who may make a deduction of marks.'

Supervisors should note that a candidate may only be given enough assistance to allow some raw readings or observations to be made. On no account should any assistance be given with the treatment or analysis of these readings and observations.

Supervisors may draw to the attention of the candidates any significant deviation between the apparatus provided and that detailed in the Question Paper, particularly where diagrams are given in the paper.

Candidates should be reminded that all their work should be written on the Question Paper. Rough paper must not be used.

The Supervisor must complete the Report at the back of these Instructions. Details should be given of any significant deviation between the apparatus used and that specified in these Instructions. A sample set of results can often help Examiners. A copy of this Report must be included in **each** packet of scripts.

**Question 1****Items to be supplied by the Centre (per set of apparatus, unless otherwise specified)**

Piece of modelling clay, e.g. Plasticine (see Note 1).

Metre rule with a millimetre scale (see Note 2).

Knife-edge (see Note 3).

50 g mass (see Note 4).

**Notes**

1. The piece of modelling clay should have a mass of  $40.0 \pm 0.5$  g. The Supervisor should check the mass with a top-pan balance. The modelling clay should be rolled into a cylindrical shape with flat ends. The diameter of the cylinder should be approximately equal to the width of the metre rule.
2. The metre rule should be stiff so that it does not bend when used to balance the 50 g mass and the modelling clay.
3. The knife-edge or prism is to be used to balance the metre rule.
4. The mass should be chosen so that it has a mass of  $50 \pm 1$  g.
5. At the changeover, the Supervisor should dismantle any apparatus left set up by the candidate. The Supervisor should ensure that the mass of the modelling clay is  $40.0 \pm 0.5$  g and the shape is correct.

**Information required by Examiners**

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

## Question 2

### Items to be supplied by the Centre (per set of apparatus, unless otherwise specified)

Wooden metre rule (see Note 1 and Note 3).

Small block of wood approximately 5 cm × 5 cm × 1 cm (see Note 2).

G-clamp (see Note 2).

A number of 100g slotted masses (see Note 3).

Means of attaching the masses to the metre rule, e.g. elastic band (see Note 4).

Optics pin in cork (see Note 5).

Stand, boss and clamp to support the optics pin horizontally (see Note 5).

Stopwatch.

### Notes

1. If a range of metre rules is available, the least stiff ones should be selected. The least stiff rules will tend to be those that are thinner. A plastic metre rule may be used if it satisfies the condition in Note 3.
2. The Supervisor should clamp the metre rule at the edge of the bench, as shown in Fig. 2.1. The rule should be clamped at the 5.0 cm mark so that 95.0 cm of the rule overhangs the bench. The edge of the block of wood should be at the 5.0 cm mark above the rule and the edge of the bench should be at the same point below the rule, so that a well defined edge is produced. The block of wood should be held in place by the G-clamp. During the experiment, the candidate will move the rule so that the edge is at the 15.0 cm mark on the rule.

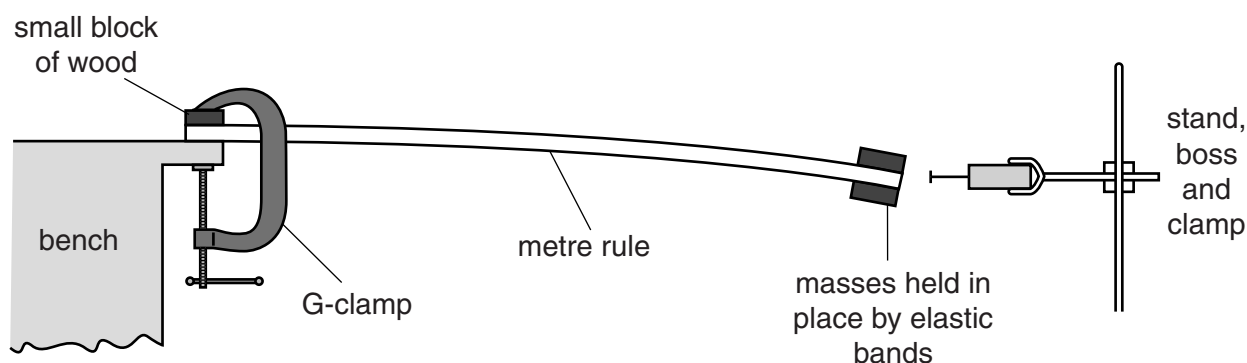


Fig. 2.1

3. The Supervisor should attach slotted masses to the metre rule so that their centre of mass is at the 95.0 cm mark on the rule. The Supervisor should then time the oscillations of the masses and adjust the number of masses until the period of the oscillations is between 0.5 s and 1.5 s.
4. The masses should be securely attached to the metre rule with elastic bands. A small amount of Blu-Tack between each mass may also be required.
5. The Supervisor should clamp the optics pin and cork horizontally at the equilibrium height of the masses attached to the rule, as shown in Fig. 2.1. If stands of sufficient height are not available, then the stand may need to be placed on a laboratory stool.
6. At the changeover the Supervisor should re-clamp the metre rule at the 5.0 cm mark on the rule, and place the optics pin and cork horizontally, as shown in Fig. 2.1.

**Information required by Examiners**

Sample set of numerical results, clearly marked “Supervisor’s Results”, obtained out of sight of the candidates.

**Question 3****Items to be supplied by the Centre (per set of apparatus, unless otherwise specified)**

100 g slotted metal mass.

60 cm length of thread (see Note 1).

250 cm<sup>3</sup> Pyrex beaker, labelled H (see Note 2).

Supply of boiling hot water (see Note 3).

Supply of water at room temperature (see Note 4).

250 cm<sup>3</sup> beaker, labelled C.

100 cm<sup>3</sup> measuring cylinder.

Two thermometers, each with a range of  $-10^{\circ}\text{C}$  to  $110^{\circ}\text{C}$ .

Stirrer (see Note 5).

Lid for beaker H (see Note 6).

Paper towels to mop up spillages.

**Notes**

1. The thread should be tied tightly to the 100 g slotted mass.
2. An adhesive label should be attached to the beaker so that the top of the label is 2 cm below the top of the beaker. A letter H should be written on the label.
3. The supply of boiling hot water could be from a kettle that has just boiled. The supply may be shared between several candidates. The Supervisor should inform candidates how to transfer the boiling hot water safely to their work station. Each candidate will need approximately 250 cm<sup>3</sup> of boiling hot water.
4. Each candidate will require approximately 100 cm<sup>3</sup> of water at room temperature. There should be sufficient water for all candidates to use. This should have been placed in a container overnight so that it is in thermal equilibrium with its surroundings. The container should be labelled 'water at room temperature'.
5. The stirrer may be a glass rod, a plastic rod or spoon, or a wooden rod. The stirrer must not be metal.
6. The lid should be cardboard or polystyrene. It should be cut to cover the top of beaker H to reduce heat loss. A hole should be cut in the middle for the thermometer.
7. At the changeover the Supervisor should
  - Remove the 100 g mass from the cold water.
  - Empty beaker C and then dry the beaker.
  - Empty beaker H.
  - Replace wet paper towels with dry ones.
  - Ensure sufficient boiling water is available for the next candidate.

**Information required by Examiners**

Sample set of numerical results, clearly marked “Supervisor’s Results”, obtained out of sight of the candidates.

**Question 4****Items to be supplied by the Centre (per set of apparatus, unless otherwise specified)**

4.5V or 5V d.c. power supply e.g. three 1.5V dry cells in suitable holders.

Metre rule with a millimetre scale.

1.1 m length of 28 swg (0.38 mm diameter) constantan wire (see Note 1).

Ammeter capable of measuring a current of up to 200 mA to 1 mA or better. An analogue or digital meter is suitable.

Voltmeter capable of measuring a potential difference of up to 1.0V to 0.01 V or better. An analogue or digital meter is suitable.

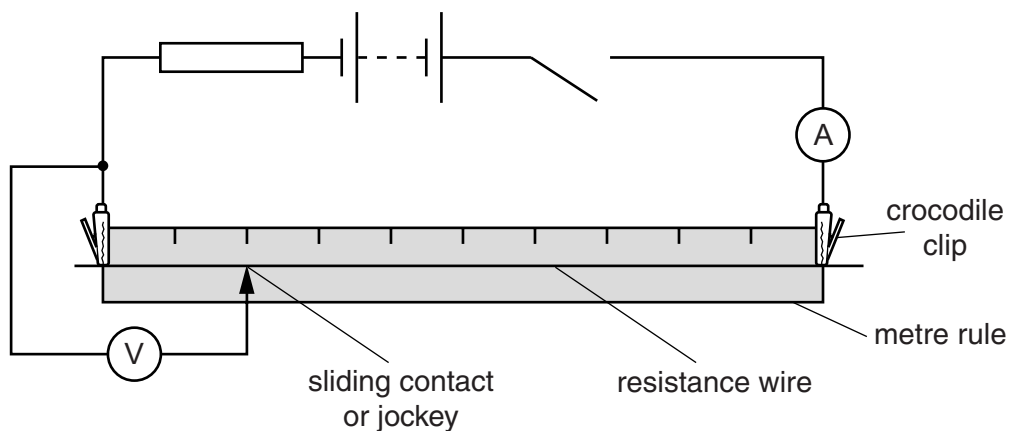
Switch or plug key.

Two crocodile clips (see Note 2).

Sliding contact or jockey (see Note 3).

22  $\Omega$  resistor to act as a protective resistor (see Note 4).

Seven connecting leads to enable the Supervisor to set up the circuit shown in Fig. 4.1.



**Fig. 4.1**



**Notes**

1. A 1.1 m length of constantan wire of 28 swg (0.38 mm diameter) should give an approximate resistance of  $4.5 \Omega$ . The constantan wire should be attached to the metre rule at three points so that it is reasonably taut. This should be done with thin strips of adhesive tape at the 3 cm, 45 cm, and 97 cm marks on the rule. If constantan wire is not available, then 24 swg (0.56 mm diameter) nichrome wire may be used as an alternative. A 1.1 m length of this wire should give an approximate resistance of  $4.5 \Omega$ .
2. The two crocodile clips are used to connect the resistance wire to the remainder of the circuit. One clip is connected to the wire at 0.0 cm and the other at 100.0 cm.
3. The candidate will need to measure the potential difference between the 0.0 cm end of the wire and other points along the wire. This can be done by using a sliding contact or jockey along the wire. This could be made by using a small screwdriver with the metal rod connected to the remainder of the circuit by means of another crocodile clip.
4. When the switch is closed, the current should be in the range 130 mA to 200 mA. If this is not the case, the value of the protective resistor or the e.m.f. of the power supply should be changed.
5. At the changeover, the Supervisor should check that the circuit is set up as in Fig. 4.1 with the switch open. When the switch is closed the current should still be in the range 130 mA to 200 mA. The sliding contact should not be connected to any point on the wire.

**Information required by Examiners**

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

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**This form must be completed and returned with the candidates' scripts.**

### REPORT ON PRACTICAL PHYSICS

The Supervisor is asked to give the following details, using the space provided on page 12.

- (a) Information required at the end of the test, as indicated in the Instructions.
- (b) Any help given to a candidate.
- (c) Any general difficulties encountered in preparing the apparatus.
- (d) Any difficulties experienced by particular candidates. These should include reference to difficulties due to faulty apparatus or materials and accidental damage to apparatus or materials. Candidates should be identified by name and candidate number.

Other cases of hardship, such as disability or illness, should be reported to CIE in the normal way.

The Supervisor is asked to provide a plan of the work benches, giving details by candidate numbers of the places occupied by the candidates for each session. The plan and report should be enclosed in the envelope containing the candidates' scripts. If more than one envelope is used, a copy of the report must be enclosed in each envelope.

#### Declaration to be signed by the Principal

The preparation of this practical examination has been carried out so as to maintain fully the security of the examination.

Signed .....

Name (in block capitals) .....

Centre number .....

Centre name .....



**Information required**

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

**Details of difficulties and any help given to candidates**