

Cambridge  
**O Level**

**Cambridge International Examinations**  
Cambridge Ordinary Level

**PHYSICS**

**5054/32**

Paper 3 Practical Test

**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.**



If you have any problems or queries regarding these Instructions, please contact Cambridge  
by e-mail: 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.

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)

Bi-convex or plano-convex converging lens of focal length in the range 14.5 cm to 15.5 cm (see Note 1).

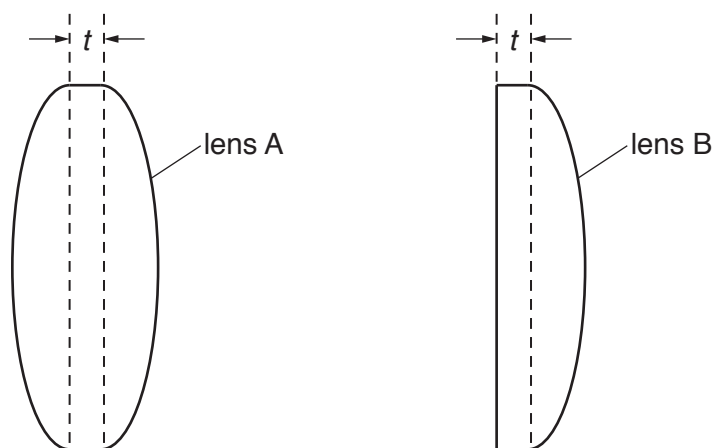
Small piece of Blu-Tack (see Note 2).

30 cm ruler with mm divisions.

Two set squares.

#### Notes

1. The bi-convex or plano-convex lens should be approximately as shown in Fig. 1.1. For some lenses the value of  $t$  may be 0 mm.



**Fig. 1.1**

2. The small piece of Blu-Tack will be used by the candidate to support the lens vertically on the ruler. If Blu-Tack is not available, Supervisors may use a small piece of modelling clay.
3. At the changeover the Supervisor should dismantle any apparatus that has been left set up by the candidate and ensure that the small piece of Blu-Tack and the **two** set squares are still present.

#### Information required by Examiners

Sample set of numerical results, clearly labelled "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)

Expendable steel spring, with a spring constant of approximately 25 N/m, e.g. Griffin catalogue number 12463080 or legacy number XBV-590-010H.

Two pieces of Blu-Tack, each of mass about 15 g (see Note 1).

150 mm plastic ruler (see Note 1).

Two thin blocks of wood, e.g. 5 cm × 5 cm × 1 cm (see Note 2).

Stand, boss and clamp to support the two blocks of wood (see Note 3).

One piece of Blu-Tack of mass about 30 g (see Note 4).

Optical pin in cork to act as a fiducial mark.

Stopwatch.

### Notes

- The Supervisor should use the two pieces of Blu-Tack, one each side of the ruler, to secure the loop at one end of the spring to the centre of the ruler. The centre of the loop should be in the centre of the ruler. This is shown in Fig. 2.1 and Fig. 2.2.

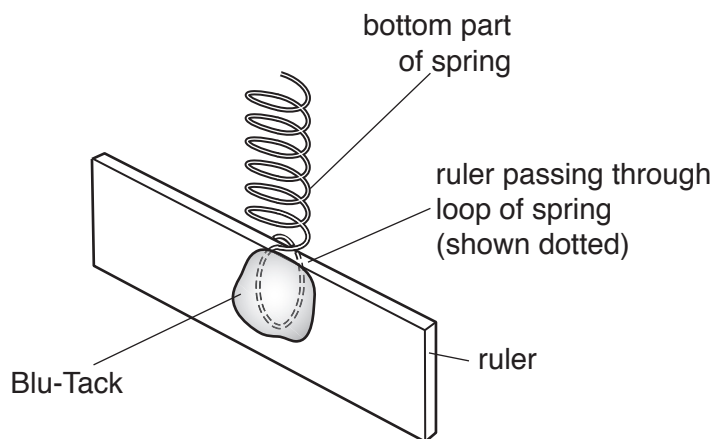


Fig. 2.1

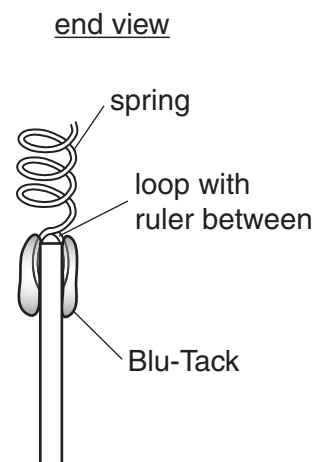


Fig. 2.2

2. The two blocks of wood are to be used to clamp the loop at the top of the spring. The arrangement is shown in Fig. 2.3.

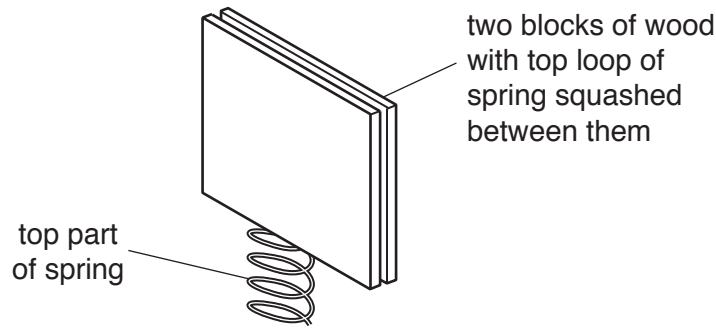


Fig. 2.3

3. The **Supervisor** should assemble the apparatus as shown in Fig. 2.4. The ruler should be horizontal and approximately 10 cm above the bench.

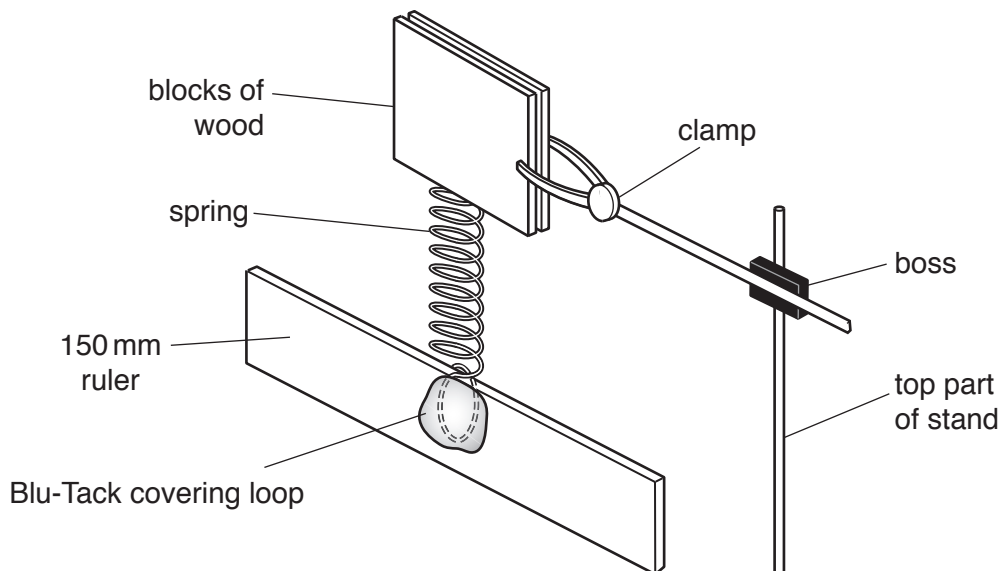


Fig. 2.4

4. **Candidates** will push this piece of Blu-Tack onto the lower edge of the ruler vertically below the spring.
5. At the changeover, the Supervisor should
- remove the Blu-Tack from the lower edge of the ruler,
  - ensure that the apparatus is still set up as shown in Fig. 2.4 with the ruler horizontal.

**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)

4.5V to 5V d.c. power supply (see Note 1).

Switch or plug key.

Two resistors each of nominal value  $10\ \Omega$  (see Note 2).

Resistor of nominal value  $22\ \Omega$  (see Note 2).

Voltmeter capable of measuring a potential difference of up to 5V to a precision of 0.1V or better. An analogue or digital meter is suitable.

Ammeter capable of measuring a current of up to 1.0A to a precision of 0.01 A or better. An analogue or digital meter is suitable.

Connecting leads (see Note 3).

#### Notes

1. The following are suitable power sources but all the candidates at a centre must be supplied with the same type of source:

- three 1.5V dry cells in suitable holders connected in series,
- four 1.2V rechargeable cells in suitable holders connected in series,
- d.c. power supply of 4V or 5V.

If a variable d.c. power supply is used, the variable control should be taped to prevent candidates altering the output voltage.

2. One of the  $10\ \Omega$  resistors should be labelled X and its value concealed from the candidates. The other two resistors should be labelled with their nominal values. The resistors should have a power rating of 1W or higher. The resistors should have suitable terminals to enable them to be connected into the remainder of the circuit. The RS component codes of suitable resistors are;  
 $10\ \Omega$  RS 707-8580  
 $22\ \Omega$  RS 707-8606

3. The Supervisor should set up the apparatus as shown in Fig. 3.1. The terminals P and Q should be clearly labelled. **Candidates** will be required to connect either the  $10\ \Omega$  resistor or the  $22\ \Omega$  resistor between P and Q.

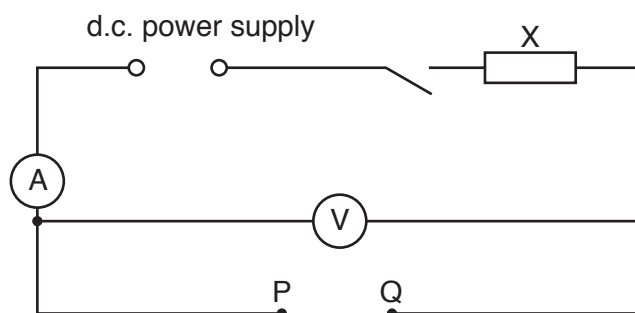


Fig. 3.1

4. At the changeover, the apparatus should be restored to its original state as in Fig. 3.1, removing any of the resistors labelled with their nominal values from the circuit. There should be a gap between P and Q. If cells are used, they should be checked and replaced, if necessary.

### Information required by Examiners

Sample set of numerical results, clearly labelled “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)

Wooden metre rule with a millimetre scale (see Note 1).

Pivot in the form of a stiff rod (see Note 2).

Stand, boss and clamp to support the pivot (see Note 3).

Expendable steel spring, with a spring constant of approximately 25 N/m, e.g. Griffin catalogue number XBV-590-010H.

30 cm ruler with millimetre divisions.

Stand, boss and clamp to support the spring (see Note 4).

100 g mass hanger with four 100 g slotted masses (see Note 5).

Loop of string (see Note 6).

Set square.

S-hook (see Note 7).

#### Notes

1. Holes should be drilled in the metre rule at the 10.0 cm mark and the 90.0 cm mark. The hole at the 10.0 cm mark should have a diameter that is slightly greater than the diameter of the pivot so that the metre rule can be freely pivoted about the 10.0 cm mark. The hole at the 90.0 cm mark should have a diameter that will allow the candidate to pass the S-hook through the hole. Any other holes in the rule should be filled with Blu-Tack to prevent the candidate using them.
2. A suitable pivot is a round nail. The point on the nail should be filed down for safety.
3. This stand should be labelled A. The Supervisor should assemble the apparatus as shown in Fig. 4.1.

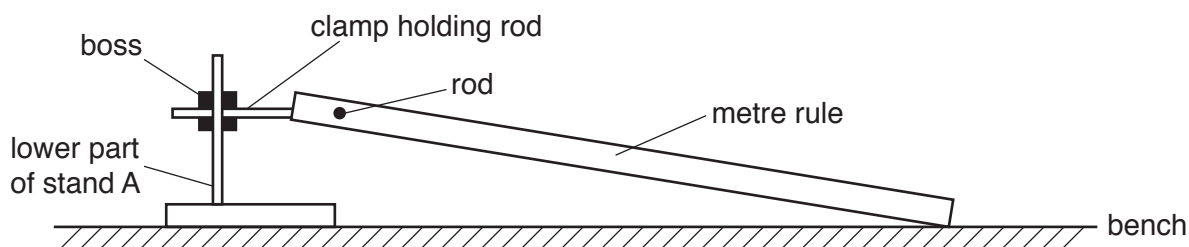


Fig. 4.1

4. This stand should be labelled B. The **candidate** will use the clamp to support the spring. This stand will need to be at least 50 cm high.
5. The masses and the mass hanger should be taped together and labelled M.



6. The loop of string should fit loosely over the metre rule so that the candidate can suspend the mass  $M$  from the rule at the 50.0 cm mark whilst it is held horizontally by the spring. The candidate will set up the apparatus as shown in Fig. 4.2.

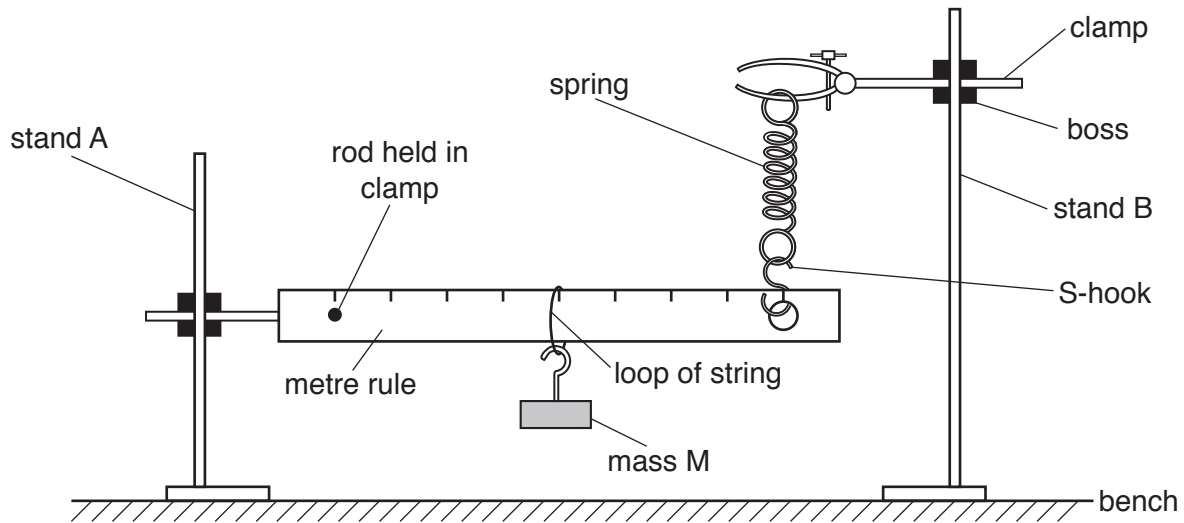


Fig. 4.2

7. This can be a piece of stiff wire bent into an S-shape. Supervisors should ensure that this does not straighten when loaded as shown in Fig. 4.2. Supervisors should also ensure that the candidate can easily pass the hook through the hole at the 90.0 cm mark on the rule.
8. At the changeover, the Supervisor should dismantle any apparatus left set up by the candidate and ensure that the apparatus is still set up as in Fig. 4.1.

**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 Cambridge 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**