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**PHYSICS**

**5054/32**

Paper 3 Practical Test

**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 **11** printed pages and **1** blank page.

## Instructions for preparing apparatus

These Confidential 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° to 180° protractor, pair of compasses and 30 cm ruler. Candidates should be advised in advance that they may, if they wish, use 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 if 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 the help given 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 Supervisor’s Report at the back of these Confidential Instructions. Details should be given of any significant deviation between the apparatus used and that specified in these Confidential Instructions. A sample set of results can often help Examiners. A copy of this Supervisor’s 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)**

Expendable steel spring with an outside diameter approximately 15 mm, coiled length approximately 20 mm and spring constant approximately 25 N/m e.g. Philip Harris product code B8G87194.

Wooden block (see note 1).

Five 100g masses.

String (see note 2).

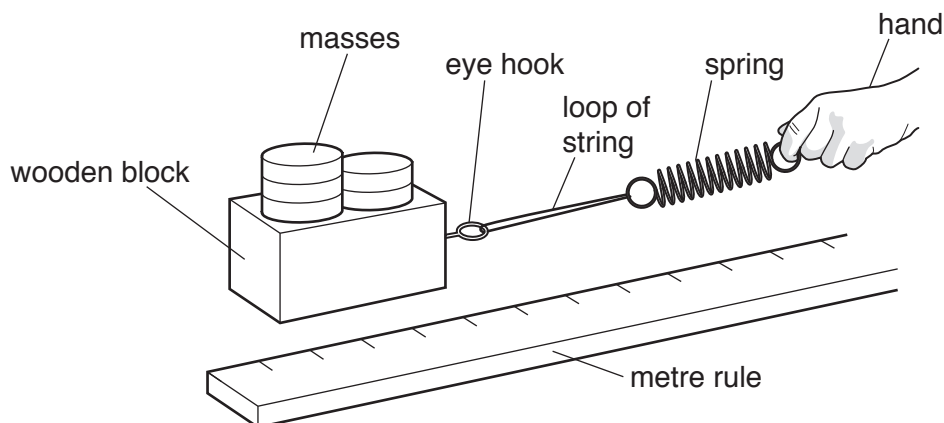
30 cm ruler with a millimetre scale.

Metre rule.

Stopwatch.

**Notes**

1. A block of wood approximately 8 cm × 4 cm × 4 cm is required. It should have a hook in the middle of one of the smaller faces so that a piece of string can be attached.
2. The string should be approximately 20 cm long, 1.5 mm wide and made of cotton or nylon. The string should be tied in a loop to the loop of the spring at one end and to the hook on the wooden block at the other end, as shown in Fig. 1.1. The string should be strong enough to support a 0.5 kg load without breaking.



**Fig. 1.1**

3. At the changeover, the Supervisor should ensure that the apparatus is restored to the arrangement shown in Fig. 1.1.

**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)

A 3 V to 3.6 V d.c. power supply (see note 1).

Switch or plug key.

three filament lamps in lamp holders (see note 2).

Resistor of resistance  $2.2\Omega$ , with a minimum power rating of 2 W, labelled R.

Voltmeter capable of measuring a potential difference up to 5.0 V to a precision of 0.1 V or better. An analogue or digital meter is suitable.

Ammeter, capable of reading up to 1.0 A to a precision of 0.05 A or better. An analogue or digital meter is suitable.

Connecting leads and crocodile clips (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:

- two 1.5 V dry cells in suitable holders connected in series
- three 1.2 V rechargeable cells in suitable holders connected in series
- d.c. power supply of 3 V.

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

2. Three small torch lamps, each of approximate diameter 1 cm, 2.5 V, 250 mA, filament indicator lamp, clear, e.g. RS 106-313. They must be placed in small holders with suitable terminals e.g. RS 171-2580.

3. Before the start of the experiment and at the changeover, the Supervisor should set up the circuit as shown in Fig. 2.1. The ends of the connecting leads from the voltmeter should be labelled P and Q. The connections at P and Q should allow further connections to be made. A further six connecting leads should be available for candidates to connect the filament lamps to the circuit. Crocodile clips may be used to connect leads to the lamp holders, if required.

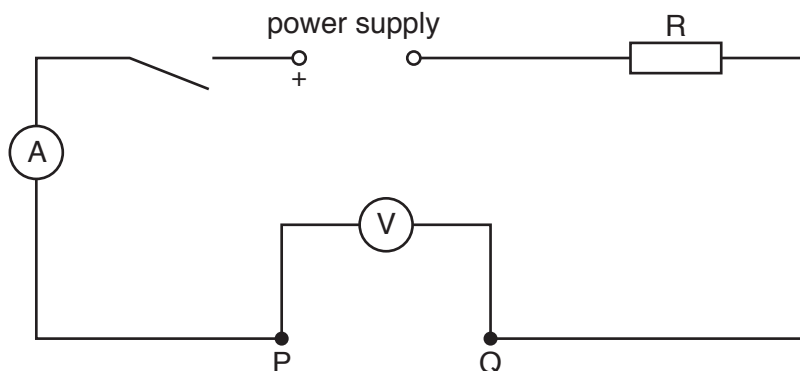


Fig. 2.1

**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)

Converging lens with a focal length of approximately 15 cm (see note 1).

Screen (see note 2).

Filament lamp in a lamp holder (see note 3).

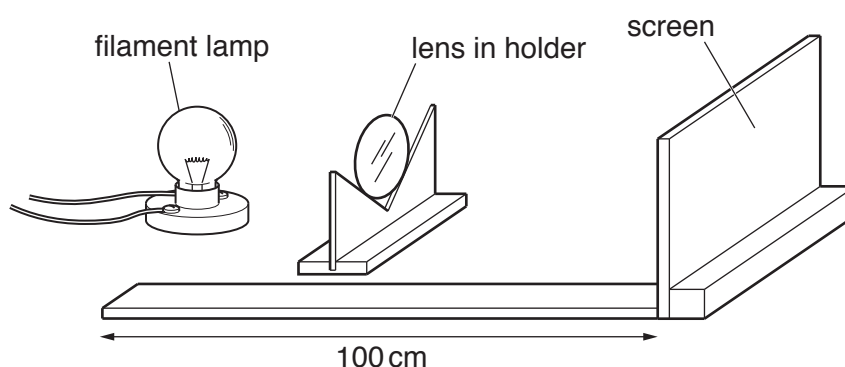
Metre rule.

30 cm ruler with a millimetre scale.

Power supply (see note 4).

#### Notes

1. The lens should be held vertically in a lens holder or fixed to the bench using Blu-tack.
2. An image of the lamp filament will be formed on the screen. The apparatus should be set up by the Supervisor, as shown in Fig. 3.1. The experiment should be performed in a darkened part of the laboratory.



**Fig. 3.1**

3. One small torch lamp, of approximate diameter 1 cm, 2.5 V, 250 mA, filament indicator lamp, clear, e.g. RS 106-313, placed in a lamp holder e.g. RS 171-2580. The lamp holder may need to be fixed to a base so that the height of the centre of the lamp is equal to the height of the centre of the lens when in use. The filament lamp should be orientated so that the filament is at right angles to the metre rule and parallel to the screen. The filament should be placed 100 cm from the screen. Supervisors should check that with the lamp switched on it is possible to form a magnified image of the filament on the screen by moving the lens alone. The apparatus should be left set up with the lens approximately half-way between the filament and the screen.
4. The power supply should be sufficient to power the lamp at its normal operating brightness.

5. At the changeover, the apparatus should be restored to its initial configuration with the filament and screen 100 cm apart and the lens half-way between the screen and the filament. The filament should be orientated so that the filament is at right angles to the metre rule and parallel to the screen.

**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)**

Metre rule to act as a balance beam (see note 2).

30 cm ruler with a millimetre scale.

Pivot (see note 3).

String.

250 cm<sup>3</sup> beaker (see note 4).

Container of cooking oil (see note 5).

Measuring cylinder with capacity 50 cm<sup>3</sup> or 100 cm<sup>3</sup>.

200 g mass (see note 6).

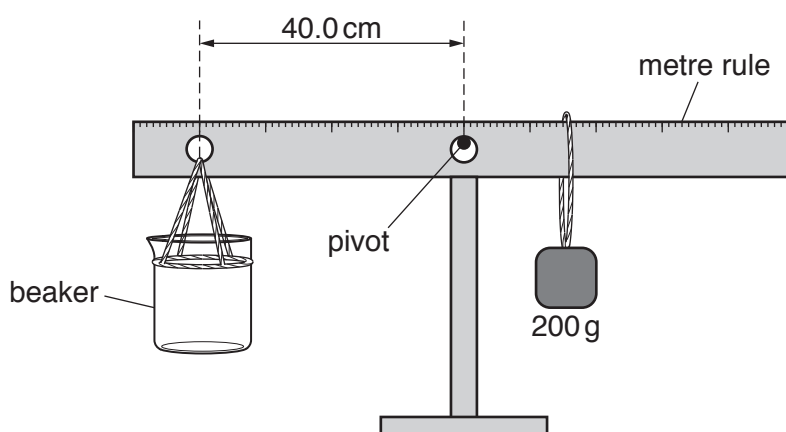
Stand, boss and, if necessary, a clamp.

G-clamp or heavy weight to fix the stand to the bench so that it does not topple.

Paper towels to mop up spillages.

**Notes**

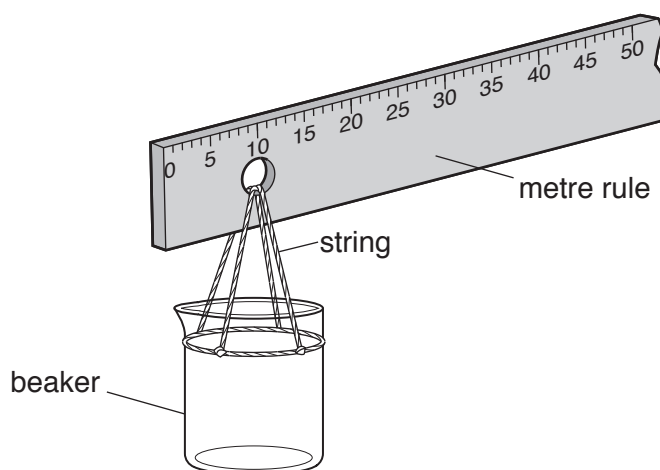
1. The Supervisor should set up the apparatus as shown in Fig. 4.1. The metre rule should be balanced. Supervisors should adjust the height of the pivot so that the beaker is no more than 5 cm above the bench.



**Fig. 4.1**



2. The rule must have holes drilled at 10.0cm and 50.0cm. The hole at 10.0cm should be wide enough to pass string through so that a beaker can be tied on and suspended freely. The hole at 50.0cm should be wide enough so that a rod acting as a pivot can pass easily through.
3. A suitable pivot is a long nail with a flat head which is held in the boss or is pressed deeply into a cork which is held in a clamp.
4. Each candidate must have a beaker identical to that used by the Supervisor. String should be tied securely around the beaker, as shown in Fig. 4.2 and attached to the metre rule at the 10.0cm hole as shown in Fig. 4.1 and Fig. 4.2.



**Fig. 4.2**

5. Each candidate will need a container holding sufficient oil to pour  $150\text{cm}^3$  into the beaker.
6. The 200g mass may be a 100g mass holder and 100g mass. It should be attached to a loop of string so that it is free to move along the length of the right-hand side of the metre rule. The mass should be positioned at the start of the experiment so that the rule is as horizontal as possible so that the candidates need only make slight adjustments.
7. At the changeover, the Supervisor should ensure that the apparatus is restored to the arrangement shown in Fig. 4.1 and ensure that there is sufficient oil for the next candidate. The oil in the beaker should be tipped back into the container. A paper towel should be used to clean the inside of the beaker before the next candidate uses the apparatus.

### Information required by Examiners

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



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

### **SUPERVISOR'S REPORT**

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 Supervisor)

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**

1. Type and e.m.f. of power source used in Question 2.

.....

2. 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**

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