

## PHYSICS

5054/32

## Paper 3 Practical Test

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.**



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 **10** printed pages and **2** blank pages.

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## 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)

One expendable steel spring, with a spring constant of approximately 25 N/m, e.g. Griffin catalogue number 12463080 or legacy number XBV-590-010H (see note 1).

String (see note 2).

Stand, boss and rod (see note 3).

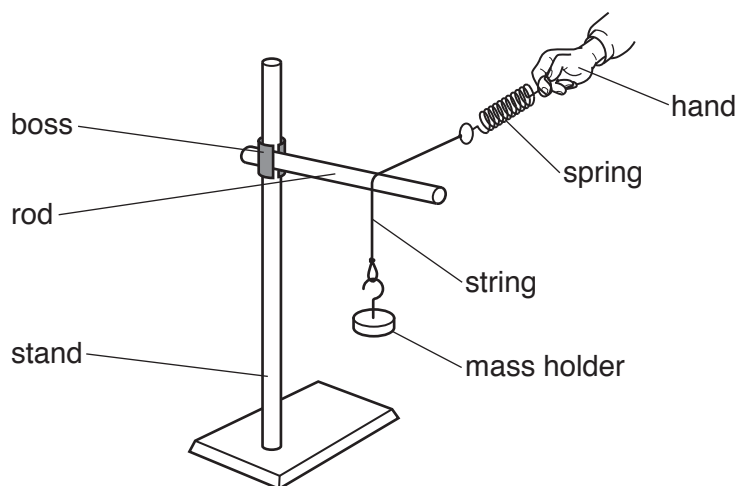
30 cm ruler with a mm scale.

G-Clamp or heavy weight (see note 4).

100 g mass holder.

#### Notes

- Supervisors should stretch any new spring by approximately 10 cm, two or three times, when setting up the experiment initially.
- The string should be approximately 30 cm long, 1.5 mm wide and made of cotton or nylon. The string should be strong enough to support a 2 kg load without stretching or breaking. One end of the string should be tied to the mass holder, the other end should be tied to the end of the spring as shown in Fig. 1.1.



**Fig. 1.1**

- A suitable rod is the rod of another retort stand held in the boss. The boss should be fixed tightly to the rod so that it does not rotate when the spring is pulled, as shown in Fig. 1.1.
- The G-Clamp should be used to fix the stand to the bench or a heavy weight should be placed on the base of the stand so that the stand does not tip over when the force is applied.
- At the changeover the Supervisor should ensure that the spring has not been permanently extended and replace it if necessary.

#### 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)**

Thermometer,  $-10^{\circ}\text{C}$  to  $110^{\circ}\text{C}$  (see note 1).

Container of hot water (see note 2).

Stopwatch, reading to 0.2 s or better.

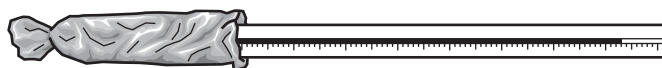
Small tube of aluminium foil (see note 3).

Supply of hot water (see note 4).

Paper towels.

**Notes**

1. The thermometer should be kept in a container of water, initially at  $90^{\circ}\text{C}$  or higher.
2. The ideal container would be a plastic jug which can hold  $500\text{cm}^3$  of hot water so that the temperature of the water does not fall below  $70^{\circ}\text{C}$  during the experiment. The thermometer will be placed in this hot water and be removed by the candidate. If a  $250\text{cm}^3$  beaker or other container of water is used, the Supervisor will need to replace the water more frequently.
3. A piece of aluminium foil  $4\text{cm} \times 8\text{cm}$  should be rolled around a cylinder (e.g. a pencil) that is slightly wider than the thermometer. The tube of aluminium should be pinched at one end. The thermometer should be able to slide in and out easily, as shown in Fig. 2.1. A few spares should also be made.



**Fig. 2.1**

4. A sufficient supply of hot water, e.g. boiling water from a kettle, for Supervisors to ensure that the temperature of the water in every candidate's container starts at  $90^{\circ}\text{C}$  or higher and does not fall below  $70^{\circ}\text{C}$ .
5. At the changeover, the Supervisor should ensure that the thermometer is in the container and that the temperature of the water in the container is at least  $90^{\circ}\text{C}$ .

**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 V to 5 V d.c. power supply (see note 1).

Switch or plug key.

Voltmeter, capable of reading up to 6.0 V and to a precision of at least 0.1 V with two connecting leads. An analogue or digital meter is suitable.

Resistor of nominal value  $47\ \Omega$ .

250 cm<sup>3</sup> beaker (see note 2).

Two 10 cm lengths of bare copper wire, 1.6 mm diameter or 16 s.w.g. (see note 2).

Measuring cylinder, either 50, 100 or 250 cm<sup>3</sup>.

Two crocodile clips.

Blu-tack (see note 2).

At least 250 cm<sup>3</sup> of salt solution in a container (see note 3).

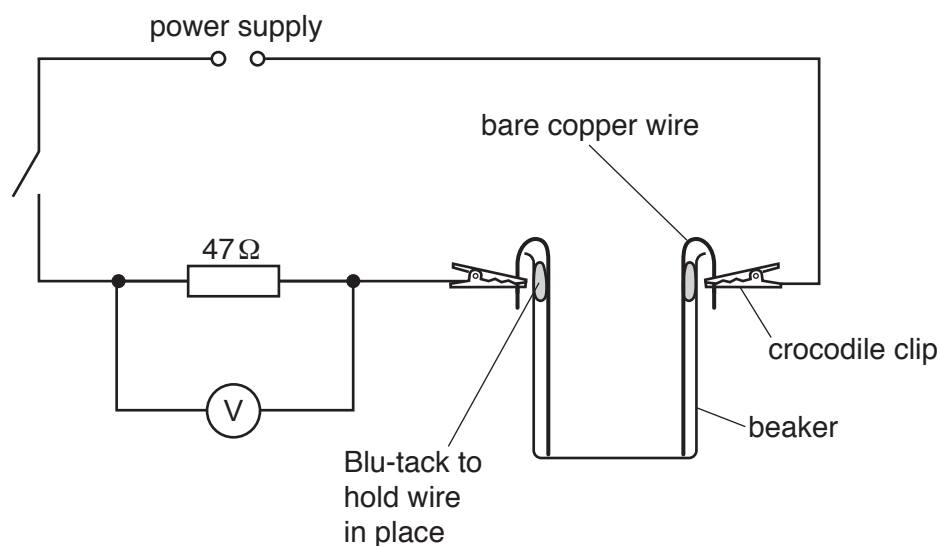
**Notes**

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

- three 1.5 V dry cells in suitable holders connected in series,
- four 1.2 V rechargeable cells in suitable holders connected in series,
- d.c. power supply of 4 V to 5 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. The wires should be fixed to the inside of the 250 cm<sup>3</sup> beaker diametrically opposite to each other. Pieces of Blu-tack can be used for this purpose. Both wires should just touch the bottom of the beaker and the excess length should be folded over the rim of the beaker and the crocodile clips should be attached, as shown in Fig. 3.1. If enamelled wire is used, the enamelling **must** be removed, e.g. by moving the wire through a Bunsen flame and then cleaning the wire.

**Fig. 3.1**

3. 10.0g of sodium chloride should be dissolved in 250 cm<sup>3</sup> of water. The solution will be re-used but it may be necessary to have extra in case of spillages.
4. At the changeover, the Supervisor should ensure that the 250 cm<sup>3</sup> beaker is dry, that the container contains at least 250 cm<sup>3</sup> of salt solution and that the switch is open.

**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)**

A steel food can with a small hole at the bottom (see note 1).

250 cm<sup>3</sup> beaker (see note 2).

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

A supply of at least 250 cm<sup>3</sup> of water for each candidate.

Stopwatch, reading to 0.2 s or better.

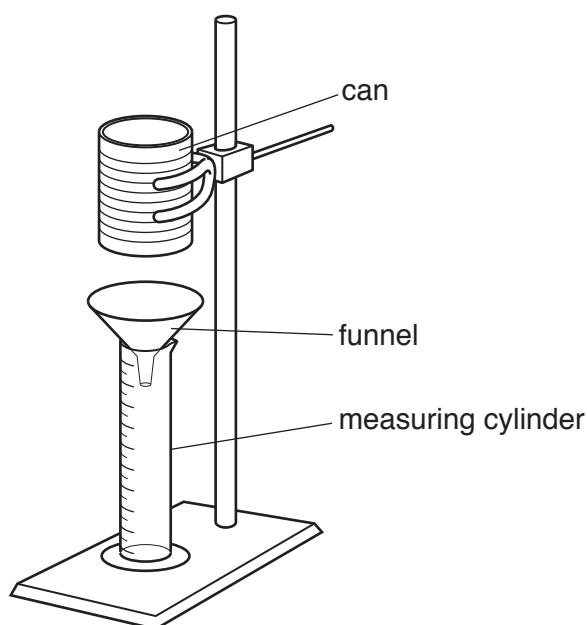
Funnel.

Stand, boss and clamp (see note 3).

Paper towels.

**Notes**

1. A standard 440 ml steel food can (107 mm in length and 75 mm in diameter) should be emptied and the lid completely removed. Any jagged or sharp edges should be filed down. A small hole should be drilled in the centre of the bottom of the can using a 1.5 mm diameter drill bit. Any distortions in the metal caused by drilling the hole should be flattened out.
2. The beaker should have a mark at the 150 cm<sup>3</sup> level. If there is no mark at this level, a mark should be made on the outside of the beaker at this level using a permanent marker pen.
3. Ensure that the jaws of the clamp are wide enough to go around the diameter of the can as shown in Fig. 4.1.



**Fig. 4.1**

4. The Supervisor should set up the apparatus as shown in Fig. 4.1. The Supervisor should ensure that the base of the can is horizontal when the can is held securely by the clamp.

5. At the changeover the Supervisor should ensure that the apparatus is restored to the arrangement shown in Fig. 4.1 with an empty measuring cylinder beneath the can.

**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 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 3.

.....

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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