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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° to 180° 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.

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Apparatus requirements for Question 1 are on the next page.

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

Metre rule, with a millimetre scale (see Note 1).

Knife-edge to act as a pivot, e.g. prism-shaped object.

Rod of length approximately 10 cm and diameter approximately 2 mm (e.g. optics pin; see Note 2).

Stand and boss to support the rod about 10 cm above the bench.

Pulley wheel, supported about 50 cm above the bench (see Note 3).

Mass with a hook, labelled S (see Note 4).

Card, with the mass of S given to the nearest gram, written in the form " $m = \dots\dots\dots$ g"

Thin string of approximate length 70 cm (see Note 5).

Half-metre rule, with a millimetre scale.

Set square.

Notes

1. The metre rule should be stiff and preferably made of wood. If the rule has two scales, one in each direction, then one scale should be covered. The 100 cm end of the rule should be labelled 'B'.
2. A hole should be drilled in the metre rule at the 1.0 cm mark. The diameter of the hole should be slightly greater than the diameter of the rod so that the metre rule can be suspended freely from the rod.
3. Candidates may need to adjust the height of the pulley wheel. If the pulley wheel is of the type that is at the end of a bar, then a stand and boss would be suitable to support the bar.
4. The value of the mass should be chosen so that it is within 10 g of 75% of the mass of the metre rule. The mass could be made up of a 10 g slotted mass hanger and an appropriate number of 10 g slotted masses securely taped together. The complete mass should be labelled S. The radius of S should be less than the diameter of the pulley wheel.

5. The Supervisor should tie a fixed loop at each end of the string. One loop should be of sufficient size so that it can easily pass around the metre rule. The second loop will pass over the hook on the mass. The **candidates** will set up the apparatus as shown in Fig. 1.1.

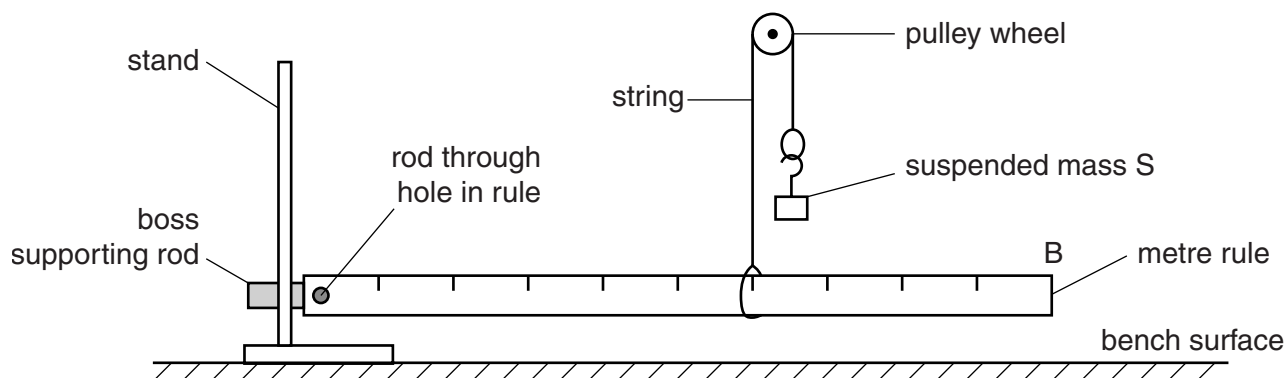


Fig. 1.1

6. At the changeover the Supervisor should dismantle any apparatus that has been left set up by the candidate.

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)**

Thin string of approximate length 1.0 m.

Spherical mass to act as a pendulum bob.

Split cork (see Note 1).

Stand, boss and clamp to support the split cork (see Note 2).

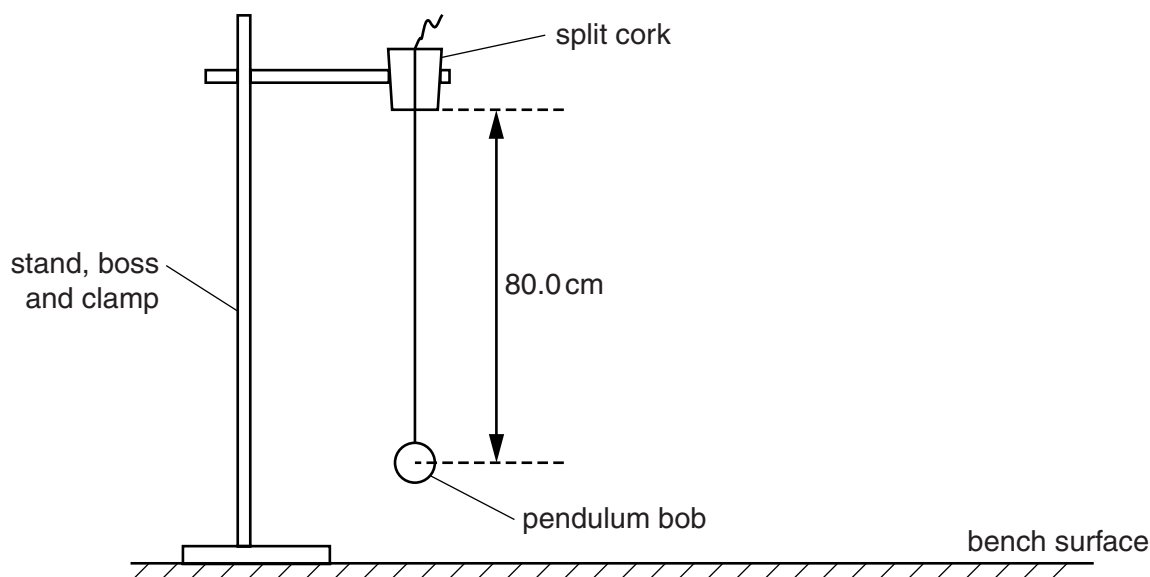
Stopwatch, reading to 0.1 s or better.

Optics pin in a cork (see Note 3).

Metre rule, with a millimetre scale.

Notes

1. One end of the thin string should be attached to the pendulum bob, and the other end should be passed through the split cork. The apparatus should then be set up by the Supervisor as shown in Fig. 2.1. The string should then be pulled through the split cork until a simple pendulum of exact length 80.0 cm, from the bottom of the split cork to the middle of the pendulum bob, is set up.

**Fig. 2.1**

2. The split cork will need to be clamped about 90 cm above the bench. If only small stands are available then the base of the stand should be secured to a flat laboratory stool, which is then placed on the bench.
3. The optics pin in the cork is to act as a fiducial marker in the centre of oscillation of the pendulum.
4. At the changeover, the Supervisor should check that the length of the pendulum is still exactly 80.0 cm.

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)**

Semi-circular Perspex or glass block of the type used in optics experiments.

Ray box with slit (see Note 1).

Protractor.

Notes

1. If a ray box with slit is not available, then a slit may be constructed as described below and a source of light may be placed behind the slit.

The slit should be formed using a 20cm square piece of card or board. A slit should be made in the card, passing vertically upwards from the centre of the base of the card. The height of the slit should be slightly greater than the height of the semi-circular block and its width should be approximately 1 mm. A piece of tracing paper should be taped across the back of the slit.

The slit should be supported so that it can stand perpendicular to the bench. This should be done by attaching blocks of wood to the base of the slit. The slit should not be obscured so two blocks should be used, one each side of the slit. This is shown in Fig. 3.1.

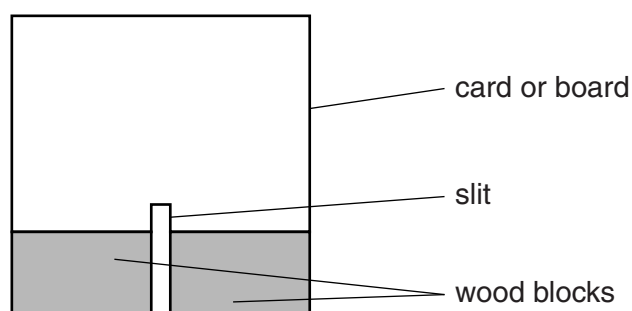


Fig. 3.1

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 5.0V d.c. power supply, e.g. three 1.5V dry cells in a suitable holder.

Ammeter capable of measuring a current of up to 20mA to 0.1 mA or better. An analogue or digital meter is suitable.

Voltmeter capable of measuring a potential difference of up to 3V to 0.1V or better. An analogue or digital meter is suitable.

Switch or plug key.

A red light-emitting diode (LED), e.g. RS Components product code 826-492 (see Note 1).

Resistor of nominal value 150Ω labelled 'resistor X', e.g. RS 131-154 (see Note 2).

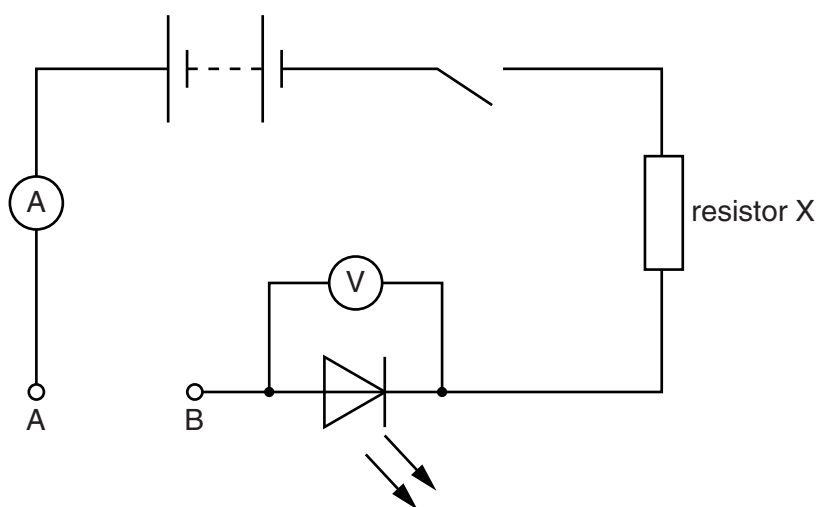
Resistors of nominal value 68Ω (e.g. RS 131-110), 180Ω (e.g. RS 131-160) and 330Ω (e.g. RS 131-198) (see Note 2).

Eight connecting leads (see Note 3).

Two further connecting leads (see Note 4).

Notes

1. The LED should have suitable terminals to enable it to be connected into the remainder of the circuit.
2. All four resistors should have suitable terminals to enable them to be connected into the remainder of the circuit. Low power resistors may be used; the RS product codes quoted are for resistors rated at 0.33W. The 68Ω , 180Ω and 330Ω resistors should be labelled with their nominal values.
3. The Supervisor should set up the arrangement shown in Fig. 4.1. The points A and B should be clearly labelled.

**Fig. 4.1**

4. The two further connecting leads are to enable the candidates to connect the three resistors in series between points A and B.
5. At the changeover the apparatus should be restored to its original state as in Fig. 4.1, removing any resistors between A and B.

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 the Syndicate 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 candidate's 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

