Cambridge
O Level

Cambridge International Examinations
Cambridge Ordinary Level

PHYSICS **5054/31**

Paper 3 Practical Test **October/November 2014**

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 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.

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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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Question 1

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 product code 12463080 or Philip Harris product code B8G87194.

Block of wood of mass 150 ± 10 g (see Note 1).

Small hook (see Note 2).

30 cm ruler with millimetre divisions.

100 g mass hanger with one 100 g slotted mass, giving a total mass of 200 g (see Note 3).

Stand, two bosses and two clamps to support the spring and 30 cm ruler (see Note 4).

Set square.

Notes

1. For wood of average density, possible dimensions for the block are 7.0 cm × 4.5 cm × 7.5 cm. One possible method for producing the blocks is to purchase a long length of wood and find, by trial and error, the correct position to cut the wood to give a mass of 150 g. Once the length has been established, identical blocks can be cut from the same long length.

2. This should be screwed into the end face of the block so that the block can be suspended from the spring.

3. The mass and mass hanger should be taped together and labelled 200 g.

4. The **candidate** will use one boss and clamp to support the spring and the second boss and clamp to support the 30 cm ruler vertically.

5. At the changeover, the Supervisor should dismantle any apparatus left set up by the candidate.

Information required by Examiners

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

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Question 2

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

Rectangular glass block (see Note 1).

Ray box with slit (see Note 2).

30 cm ruler with millimetre divisions.

Protractor.

Notes

1. The rectangular glass block should have straight rather than bevelled edges. A rectangular Perspex block may be used as an alternative to glass, but a note of this should be made on the 'Report on Practical Physics' page. The longest side of the block should have a length between 7 cm and 16 cm.

2. 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 20 cm 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 transparent 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 wooden blocks 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. 2.1.

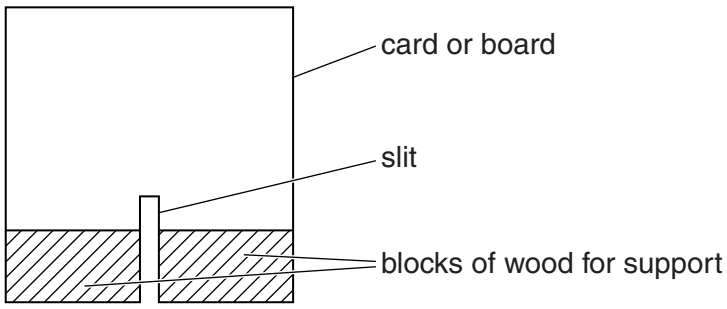

Fig. 2.1

3. At the changeover, the Supervisor should check that all the apparatus is still present.

Information required by Examiners

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

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Question 3

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

Block of wood of mass approximately 200 g (see Note 1).

Ramp (see Note 2).

Support for the ramp of approximate height 15 cm, e.g. block of wood.

Pulley with a means of supporting it close to the top of the ramp.

Small hook (see Note 3).

10 g slotted mass hanger, nine 10 g slotted masses and two 100 g slotted masses (see Note 4).

Length of thin string (see Note 5).

Blu-Tack (see Note 6).

Metre rule with a millimetre scale.

Set square.

Stopwatch reading to 0.1 s or better.

Notes

1. One of the larger faces of the block of wood should be labelled A. The mass of the block, given to the nearest 0.001 kg, should also be written on the label in the form "*M* = ……. kg".

2. The ramp should be approximately 1 m long and 15 cm wide. The top of the ramp should be supported at the edge of the bench and the bottom of the ramp will rest on the bench. The block of wood will be pulled up the ramp by a falling mass. The mass will only be able to fall a distance which is approximately equal to the height of the bench. It is necessary to stop the block of wood when it has moved this distance up the ramp. This can be achieved using a 15 cm length of wood perpendicular to the side of the ramp. This should have a rectangular cross section and should be fixed to the ramp to form a stop. This is shown in Fig. 3.1. The ramp should be stiff so that it does not bend when the block of wood moves up it.

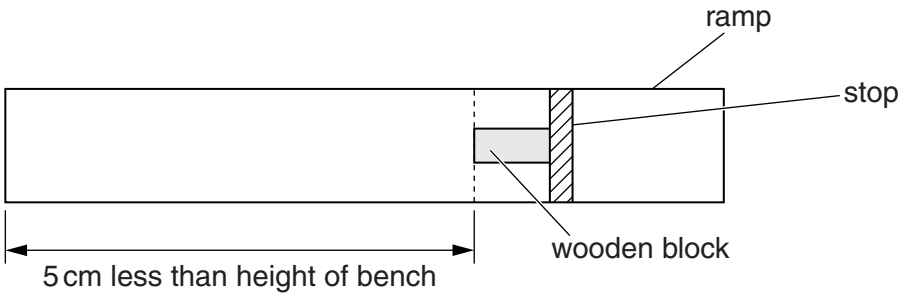

Fig. 3.1 (top view)

3. The small hook should be screwed into one end of the wooden block. The bottom of the hook must be above the stop when the block hits the stop.

4. The Supervisor should check that all the slotted masses will fit onto the mass hanger at the same time.

5. One end of the thin string should be tied to the hook and the other end should be tied to the mass hanger. The length of the string should be chosen so that, when the block is in the position shown in Fig. 3.2, the mass hanger is just below the pulley. The apparatus should then be assembled as shown in Fig. 3.2. The height of the pulley should be adjusted so that the string is parallel to the ramp.

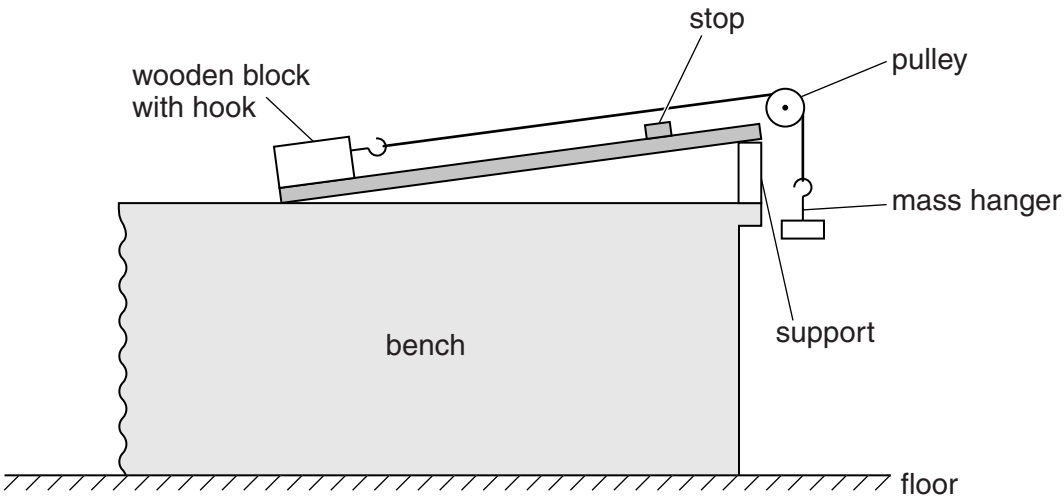

Fig. 3.2

6. The Supervisor may wish to use Blu-Tack to secure the ramp in position.

7. At the changeover, the Supervisor should remove any masses from the mass hanger and should ensure that the apparatus is still set up as shown in Fig. 3.2.

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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Question 4

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

A power source (see Note 1).

Switch or plug key.

Metre rule with a millimetre scale.

1.1 m length of 28 swg (0.38 mm diameter) or 30 swg (0.32 mm diameter) resistance wire (see Note 2).

Card on which is written the resistance of a 100.0 cm length of the resistance wire to the nearest 0.1 Ω in the form "R = …….. Ω".

Two crocodile clips (see Note 3).

Resistor labelled X (see Note 4).

Four connecting leads to enable the Supervisor to set up the circuit shown in Fig. 4.1. The points A, B, C and E should be labelled.

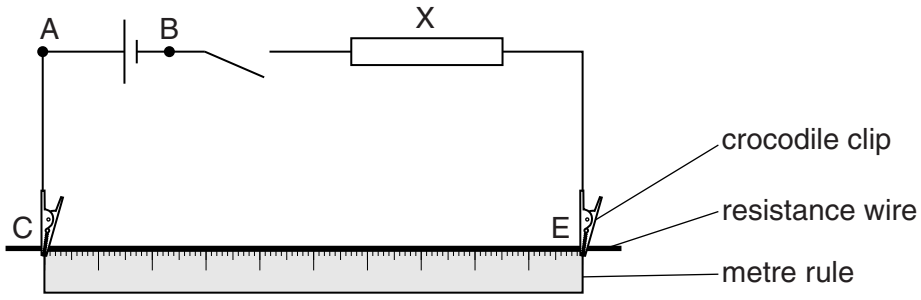

Fig. 4.1

Voltmeter capable of measuring a potential difference of up to 2.0 V to a precision of 0.01 V or better. An analogue or digital meter is suitable (see Note 5).

Sliding contact or jockey (see Note 6).

Two connecting leads to enable the **candidate** to connect the voltmeter into the circuit.

Notes

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

- 1.5V dry cell in a suitable holder,
- 1.2V rechargeable cell in a suitable holder,
- d.c. power supply of 1.5V or 2V.

If a d.c. power supply is used, the Supervisor should tell candidates that a d.c. power supply has been used instead of the cell shown on the circuit diagram. If a variable d.c. power supply is used, the variable control should be taped to prevent candidates altering the output voltage.

2. Nichrome wire or constantan wire should be used. The 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 3cm, 45cm and 97cm marks on the rule. The same resistance wire should be used at all stations at a given Centre. The Supervisor may need to clean the wire gently with fine abrasive paper prior to the start of the experiment.

3. The two crocodile clips are used to connect the resistance wire to the remainder of the circuit. The clips are connected to the wire as close as possible to 0.0cm and 100.0cm.

4. The resistor X should have suitable terminals to enable it to be connected into the remainder of the circuit. The value of this resistor should be chosen to be about $\frac{1}{3}$ of the value of the resistance of the resistance wire. Fig. 4.2 gives possible values. Also given are the RS Components product codes for 0.25W resistors, which are suitable for this experiment.

Resistance wire	Resistor X	0.25W resistors
28swg nichrome	3.3Ω	707-7464
30swg nichrome	4.7Ω	707-7489
28swg constantan	1.5Ω	707-7445
30swg constantan	2.2Ω	707-7454

Fig. 4.2

5. The Supervisor should ensure that it is possible to measure the e.m.f. of the power supply with the voltmeter.

6. The candidate will also need to connect the voltmeter between C and 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.

7. At the changeover, the Supervisor should check that the circuit is set up as in Fig. 4.1 with the switch open. The voltmeter should be disconnected from the circuit and the two connecting leads and sliding contact should be placed on the bench. If cells are used, they should be checked, and replaced if necessary.

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Information required by Examiners

1. The resistance of X used at all stations.

2. 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 .....

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[Turn over

Information required

1. Resistance of resistor X.

resistance = ...

2. For questions 1, 2, 3 and 4, 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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