



Cambridge O Level

PHYSICS

5054/31

Paper 3 Practical Test

October/November 2021

CONFIDENTIAL INSTRUCTIONS

This document gives details of how to prepare for and administer the practical exam.

The information in this document and the identity of any materials supplied by Cambridge International are confidential and must NOT reach candidates either directly or indirectly.

The supervisor must complete the report at the end of this document and return it with the scripts.

INSTRUCTIONS

- If you have any queries regarding these confidential instructions, contact Cambridge International stating the centre number, the syllabus and component number and the nature of the query.
email info@cambridgeinternational.org
phone +44 1223 553554

This document has **12** pages.

General information about practical exams

Centres must follow the guidance on science practical exams given in the *Cambridge Handbook*.

Safety

Supervisors must follow national and local regulations relating to safety and first aid.

Only those procedures described in the question paper should be attempted.

Supervisors must inform candidates that materials and apparatus used in the exam should be treated with caution. Suitable eye protection should be used where necessary.

The following hazard codes are used in these confidential instructions, where relevant:

| | | | |
|-----------|--------------------------------------|-----------|-----------------|
| C | corrosive | MH | moderate hazard |
| HH | health hazard | T | acutely toxic |
| F | flammable | O | oxidising |
| N | hazardous to the aquatic environment | | |

Hazard data sheets relating to substances used in this exam should be available from your chemical supplier.

Before the exam

- The packets containing the question papers must **not** be opened before the exam.
- It is assumed that standard school laboratory facilities, as indicated in the *Guide to Planning Practical Science*, will be available.
- Spare materials and apparatus for the tasks set must be available for candidates, if required.

During the exam

- It must be made clear to candidates at the start of the exam that they may request spare materials and apparatus for the tasks set.
- Where specified, the supervisor **must** perform the experiments and record the results as instructed. This must be done **out of sight** of the candidates, using the same materials and apparatus as the candidates.
- Any assistance provided to candidates must be recorded in the supervisor's report.
- If any materials or apparatus need to be replaced, for example, in the event of breakage or loss, this must be recorded in the supervisor's report.

After the exam

- The supervisor must complete a report for each practical session held and each laboratory used.
- Each packet of scripts returned to Cambridge International must contain the following items:
 - the scripts of the candidates specified on the bar code label provided
 - the supervisor's results relevant to these candidates
 - the supervisor's reports relevant to these candidates
 - seating plans for each practical session, referring to each candidate by candidate number
 - the attendance register.

Specific information for this practical exam

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. Candidates should be advised in advance that they may, if they wish, use wrist-watches with stop-watch facilities, providing that such wrist-watches afford the required precision.

Question 1

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

- ray box with slit and suitable power supply (see Note 1)
- two plane mirrors no smaller than 4 cm × 7 cm (see Note 2)
- tape to tape the two mirrors together
- a small amount of adhesive putty (e.g. Blu Tack or Patafix)
- protractor.

Notes

1. If a ray box with slit is unavailable, a slit plate should be cut from a piece of rigid card into a rectangle of length 80 mm and width 50 mm. A slit of width 1.0 mm and length 25 mm should be cut into the card at 25 mm, as shown in Fig. 1.1.

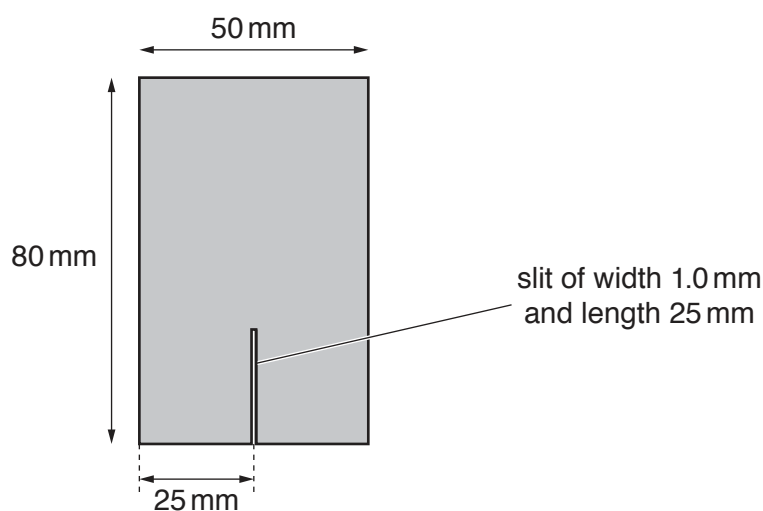


Fig. 1.1

The slit should be illuminated by a 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 171-2603. The lamp holder must be fixed to the bench with a piece of adhesive putty and tilted, as shown in Fig. 1.2.

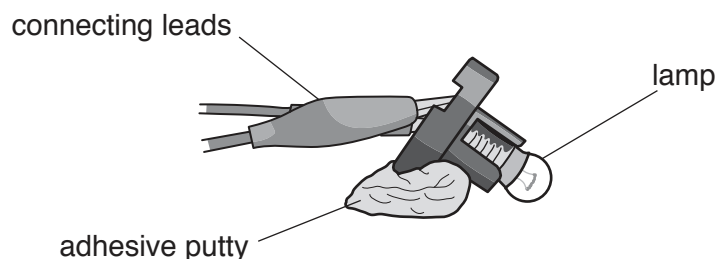


Fig. 1.2

Pieces of adhesive putty should be fixed to the bottom corners of the slit plate, as shown in Fig. 1.3.

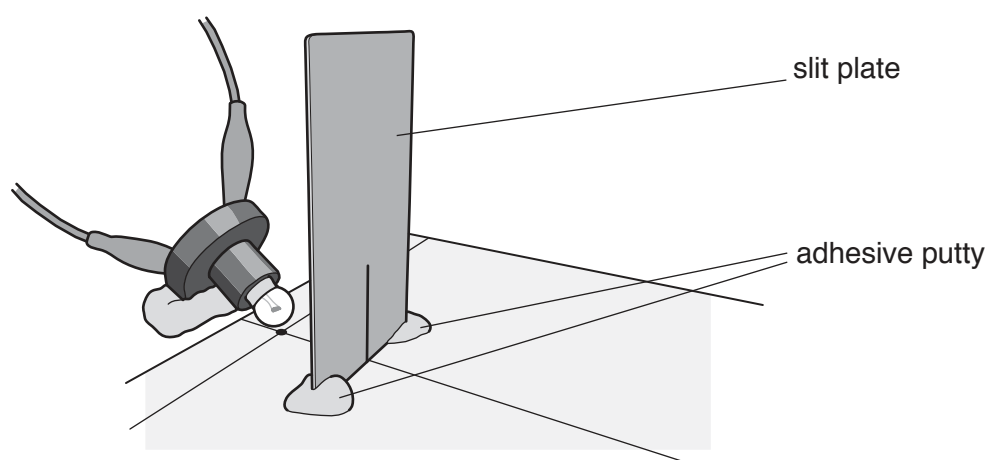


Fig. 1.3

The following are suitable power sources:

- two 1.5V dry cells in suitable holders connected in series
- three 1.2V rechargeable cells in suitable holders connected in series
- d.c. power supply of 3.0V. If a variable power supply is used the supervisor must ensure that the candidates cannot alter the output voltage.

2. Place the mirrors so that their reflecting surfaces are facing. Use strong adhesive tape across one edge to join them together, as shown in Fig. 1.4. Using the tape as a hinge, candidates should be able to vary the angle between the mirrors.

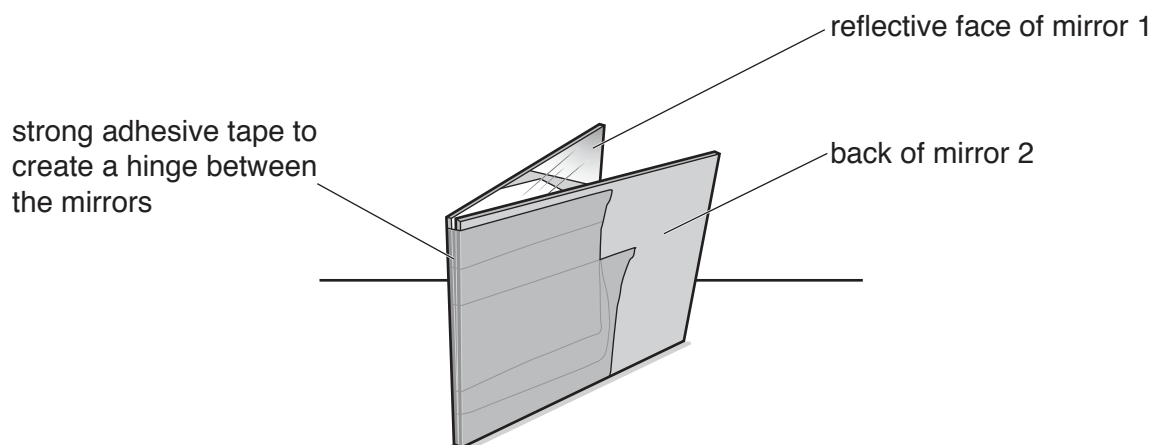


Fig. 1.4

The experiment must be performed in a darkened part of the laboratory.

Action at changeover

The supervisor should ensure that the power supply is still capable of illuminating the lamp at a suitable brightness and is then switched off.

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):

- power supply (see Note 1)
- switch or plug key
- two lamps in lamp holders (see Note 2)
- light dependent resistor placed on a piece of card labelled 'Light Dependent Resistor' (see Note 3 and Note 4)
- fixed resistor of resistance $47\ \Omega$, $\pm 5\%$, 1W placed on a piece of card labelled 'Resistor' (see Note 4)
- ammeter capable of measuring a current up to 0.25A (or 1.00A) to a precision of 0.01A or better. An analogue or digital meter is suitable
- voltmeter capable of measuring a potential difference of 5.0V to a precision of 0.1V or better. An analogue or digital meter is suitable
- sufficient connecting leads and crocodile clips to set up the circuit shown in Fig. 2.1 (see Note 4).

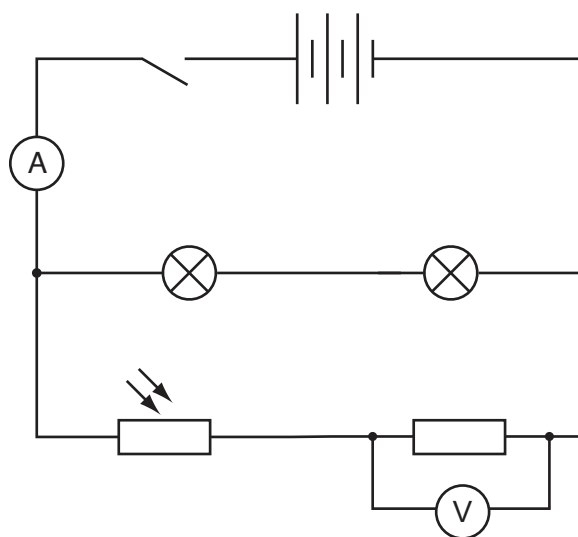


Fig. 2.1

Notes

1. The following are suitable power sources:

- three 1.5V dry cells in suitable holders connected in series
- three 1.2V rechargeable cells in suitable holders connected in series
- d.c. power supply of 4.5V. Where candidates are provided with a power supply with a variable output p.d., the p.d. must be set by the supervisor and fixed (e.g. taped).

2. Small torch lamps of approximate diameter 1 cm, 2.5V, 250 mA, filament indicator lamps, clear, e.g. RS 106-313 placed in a lamp holder e.g. RS 171-2603.
3. A suitable LDR is the Silonex NORPS-12. The RS component code is 914-6714.
4. The supervisor should set up the circuit shown in Fig. 2.1. Short connecting leads should be used so that there is no overlapping and the layout of the circuit is clearly visible to the candidate. The resistor must also be placed on a card labelled 'Resistor' and the LDR should be placed on a card labelled 'Light Dependent Resistor'.

Action at changeover

The supervisor must ensure that the circuit is as shown in Fig. 2.1 with the switch open.

Information required by examiners

Sample set of numerical results, clearly marked 'supervisor's results', obtained out of sight of the candidates. **Take a photograph** of one circuit when set up before the examination, and include it with the supervisor's report.

Question 3

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

- table tennis ball
- inclined slope made from two metre rules (see Note)
- stop-watch accurate to 0.1 s or better
- adhesive putty (e.g. Blu Tack or Patafix)
- modelling clay or an alternative method of securely supporting the top ends of the metre rules
- piece of cloth to catch ball.

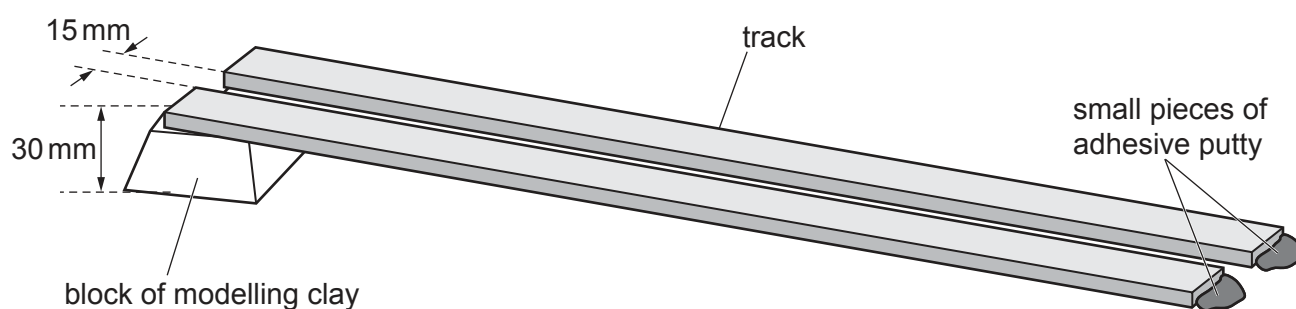


Fig. 3.1

Note

The track is made from two metre rules placed side by side 15 mm apart. The scale of each rule must face upwards. One end of the track is pressed into a block of modelling clay so that the top of the track is 30 mm above the bench. The other end of the track is secured in place by two pieces of adhesive putty, as shown in Fig. 3.1. A piece of cloth should be placed on the bench 5 cm from the bottom of the track to stop the ball.

The 100 cm marks on the rules must be at the top end of the track.

Action at changeover

The supervisor must ensure that the apparatus is in the configuration shown in 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):

- one expendable steel spring, with a spring constant of approximately 25 N/m e.g. Philip Harris catalogue number B8G87194 (see Note 1)
- strong tape to secure the ends of the spring to the bosses
- safety goggles
- adhesive putty (e.g. Blu Tack or Patafix) of approximate mass 70 g (see Note 1)
- two stands, bosses and heavy weights. Masses of 2 kg or more e.g. a plastic 2 L bottle filled with water may be required (see Note 2)
- rod of length 40 cm (see Note 3)
- adhesive putty (e.g. Blu Tack or Patafix) of mass 15 g (see Note 3)
- half-metre rule
- stop-watch accurate to 0.1 s or better.

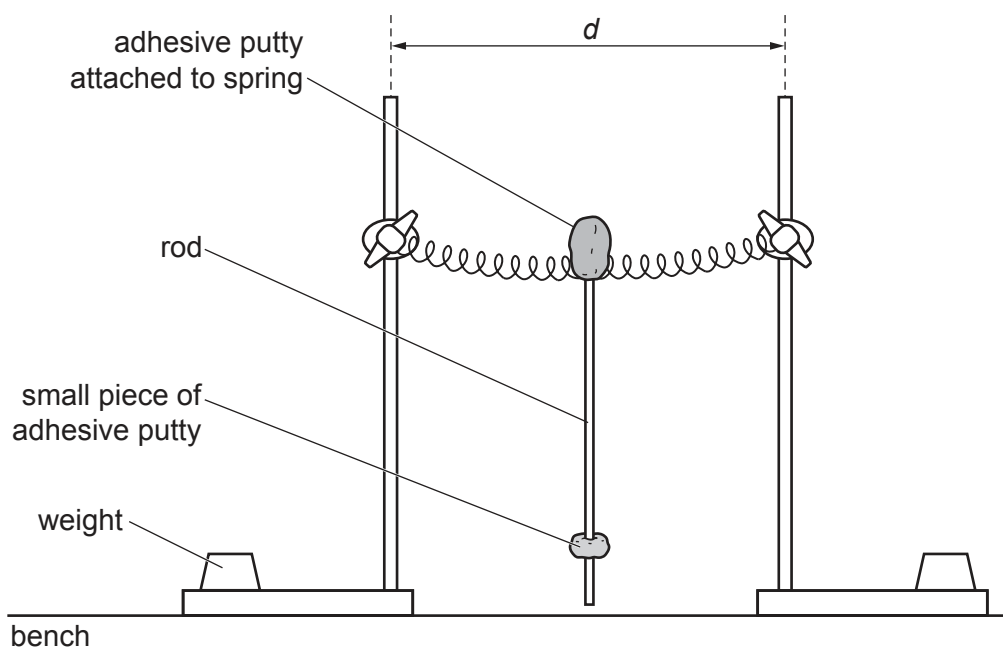


Fig. 4.1

Notes

1. The spring should be extended between the two bosses 26 cm apart and the larger mass of adhesive putty should then be moulded firmly around and into the central coils of the spring and shaped so that it is approximately cylindrical 2.5 cm wide and 5 cm in diameter, as shown in Fig. 4.1. The ends of the spring should be securely taped to the bosses to prevent it springing loose during the experiment.

Candidates should wear safety goggles while doing this experiment.

2. The stands should be placed a distance $d = 26$ cm apart, as shown in Fig. 4.1. To prevent the stands toppling, heavy weights should be placed at the ends of their bases and the bosses should be attached at a minimum height that is just sufficient to allow the rod to rotate freely in a forwards and backwards motion without hitting the bench.
3. A rod of length 40 cm should be pushed all the way through the adhesive putty attached to the spring. A 6 mm diameter wooden rod is suitable. The small piece of adhesive putty should be pressed into place around the rod to make a disc of approximate diameter 3 cm near to the bottom end of the rod, as shown in Fig. 4.1. It must be possible for candidates to adjust the position of the adhesive putty on the rod and for the adhesive putty to adhere to the rod without slipping.

Action at changeover

The supervisor must ensure that the apparatus is in the configuration shown in Fig. 4.1, with the small piece of adhesive putty near the bottom of the rod.

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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Supervisor's report

Syllabus and component number

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Centre number

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Centre name

Time of the practical session

Laboratory name/number

Give details of any difficulties experienced by the centre or by candidates (include the relevant candidate names and candidate numbers).

You must include:

- any difficulties experienced by the centre in the preparation of materials
- any difficulties experienced by candidates, e.g. due to faulty materials or apparatus
- any specific assistance given to candidates.

Space for supervisor to record results, if relevant, e.g. temperature of the laboratory; results for Question 1.

Declaration

- 1 Each packet that I am returning to Cambridge International contains all of the following items:
 - the scripts of the candidates specified on the bar code label provided
 - the supervisor’s results relevant to these candidates
 - the supervisor’s reports relevant to these candidates
 - seating plans for each practical session, referring to each candidate by candidate number
 - the attendance register.
- 2 Where the practical exam has taken place in more than one practical session, I have clearly labelled the supervisor’s results, supervisor’s reports and seating plans with the time and laboratory name/number for each practical session.
- 3 I have included details of difficulties relating to each practical session experienced by the centre or by candidates.
- 4 I have reported any other adverse circumstances affecting candidates, e.g. illness, bereavement or temporary injury, directly to Cambridge International on a *special consideration form*.

Signed (supervisor)

Name (in block capitals)