



Cambridge O Level

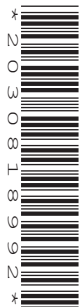
PHYSICS

5054/32

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)
- protractor
- tape to tape the two mirrors together (see Note 2)
- 30 cm ruler
- adhesive putty (e.g. Blu Tack or Patafix) for use with alternative slit (see Note 1) as well as a small amount to be given to candidates.

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.

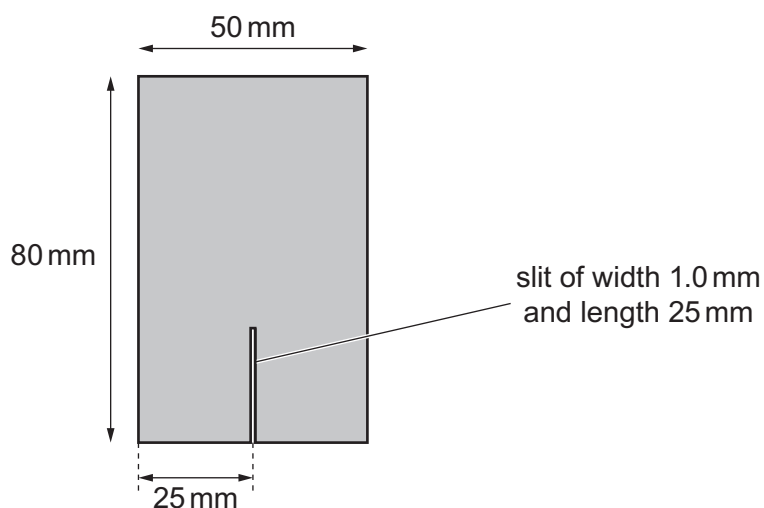


Fig. 1.1

The slit should be illuminated by a small torch lamp of approximate diameter 1 cm, 2.5V, 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.

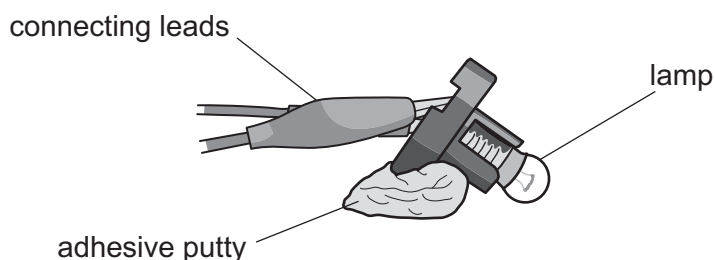


Fig. 1.2

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

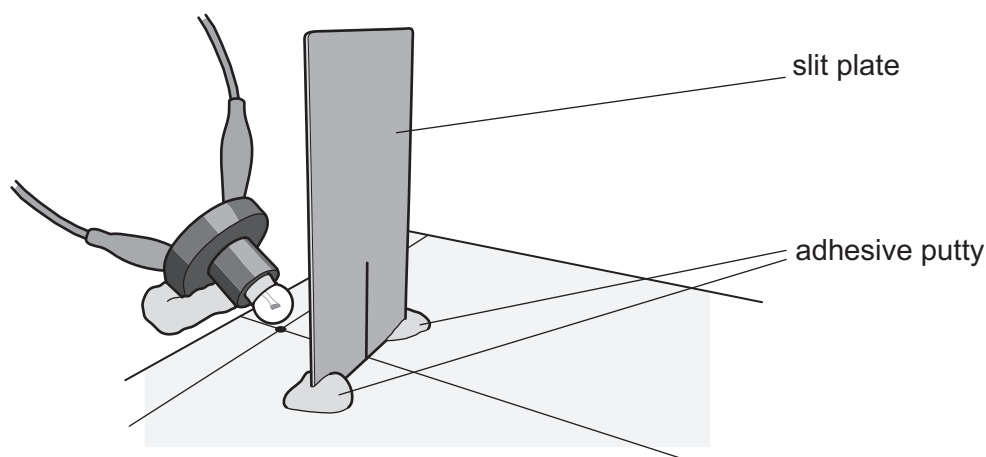


Fig. 1.3

A power supply with a potential difference of 3.0V is sufficient to power the lamp at a suitable brightness.

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 glass 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.

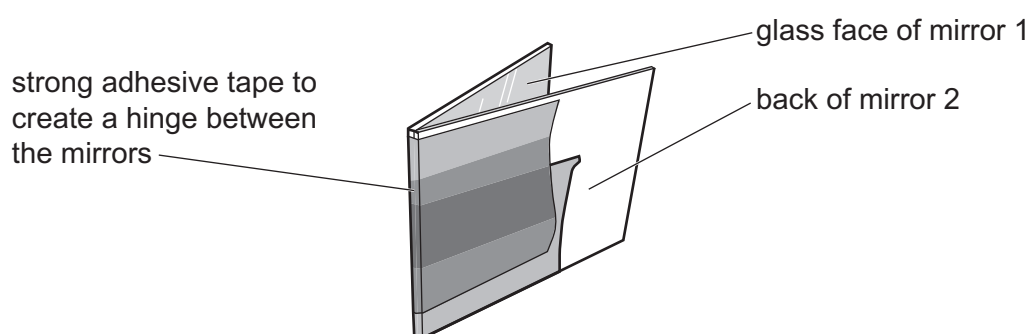


Fig. 1.4

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

Set of five 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
- lamp (see Note 2)
- negative temperature coefficient disc thermistor placed on a piece of card labelled 'thermistor' (see Note 3)
- fixed resistor of resistance $2.2\text{ k}\Omega$, $\pm 5\%$, 0.25 W placed on a piece of card labelled 'resistor'
- 250 cm^3 beaker containing about 200 cm^3 of an ice and water mixture (see Note 4)
- voltmeter capable of measuring a potential difference of 5.0 V to a precision of 0.1 V 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).

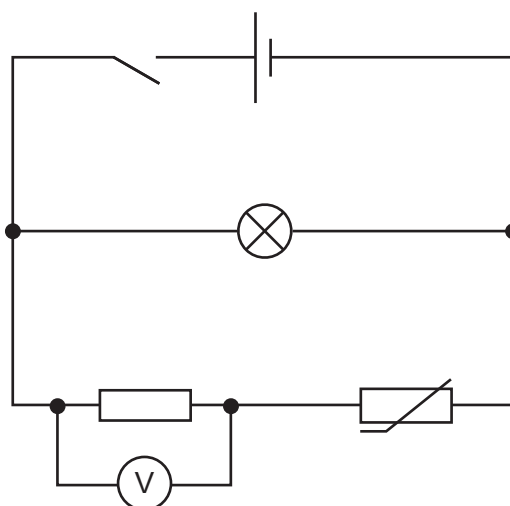


Fig. 2.1

Notes

1. The power supply should be made from a 1.5 V dry cell in a suitable holder.
2. 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.
3. A suitable disc thermistor has a resistance of about $500\ \Omega$ at 25°C and $1500\ \Omega$ at 0°C . The RS component code of such a thermistor is RS 191-2229. The thermistor and the resistor must be placed on the pieces of cards labelled with their names.
4. The supervisor should set up the circuit shown in Fig. 2.1. The beaker of ice and water should be placed safely away from the circuit. The thermistor must be connected to the circuit by leads long enough to allow it to be safely dipped into the beaker of ice and water.

Action at changeover

The supervisor must ensure that the circuit is as shown in Fig. 2.1 with the switch open. Supervisors should check that the cell is fully charged and replace it if necessary. The supervisor must also check that the ice in the ice-water mixture has not all melted away and replenish with ice if necessary.

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):

- twine (see Note 1)
- pulley with a diameter of 50 mm
- two 100 g mass hangers
- piece of modelling clay or adhesive putty (e.g. Blu Tack or Patafix) (see Note 2)
- metre rule
- set square
- stop-watch reading to 0.1 s or better
- stand, boss and clamp
- a heavy weight or G-clamp (see Note 3).

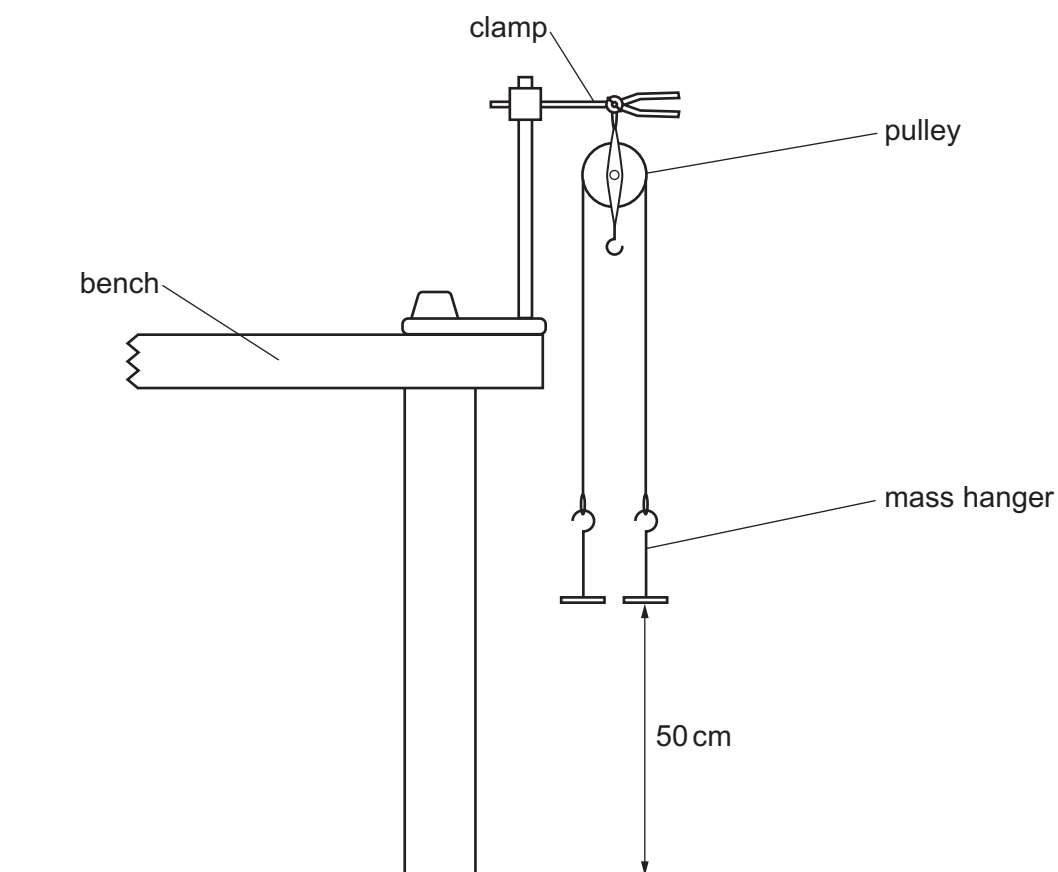


Fig. 3.1

Notes

1. Twine is a light string or strong thread composed of two or more smaller strands or yarns twisted, and then twisted together.

A length of 2 mm diameter twine should be cut and loops tied at each end. The total length of the twine will be approximately 145 cm.

With the mass hangers placed on the ends of the loops, as shown in Fig. 3.1, the position of the clamp must be adjusted so that the base of each mass hanger is approximately 50 cm above the floor. It must be possible for one of the mass hangers to be lowered all the way to the floor so that as the other mass hanger rises it does not collide with the pulley or with the other mass hanger.

2. A piece of modelling clay of approximate mass 7 grams should be rolled into a ball and placed on a piece of card near the apparatus. The precise mass of the modelling clay should be adjusted so that when it is placed on one of the mass hangers, the mass hanger is able to descend slowly towards the floor when given a small push downwards. If modelling clay is unavailable, adhesive putty is also suitable.
3. To prevent the stand toppling over it should be secured to the bench by placing a heavy weight on the base or by fastening it with a G-clamp.

Action at changeover

The supervisor must ensure that the apparatus is in the configuration shown in Fig. 3.1 with the piece of modelling clay or adhesive putty rolled into a ball on top of the piece of card.

Information required by examiners

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

THE LIST OF APPARATUS FOR Q4 STARTS OVER THE PAGE.

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Question 4

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

- metre rule with mm divisions (see Note 1)
- 100 g slotted mass (see Note 2)
- triangular block to act as a pivot (see Note 3)
- metal rod to act as a pivot (see Note 4)
- stand, boss and G-clamp or heavy weight
- stop-watch reading to 0.1 s or better.

Notes

1. A hole of approximate diameter 6 mm must be drilled at 5.0 cm mark on the scale face of the metre rule. Eighteen more holes must then be drilled along the face of the rule every 5.0 cm from the 10 cm mark to the 95 cm mark. The rod must pass easily into the holes.
2. The central slot of the 100 g slotted mass must be aligned with the 80.0 cm mark of the metre rule. The mass should then be securely attached to the metre rule using clear adhesive tape to ensure that it does not slip. With the mass attached, the distance r shown in Fig. 4.1 must be $65 \text{ cm} \pm 3 \text{ cm}$ when the rule is balanced horizontally on the pivot.

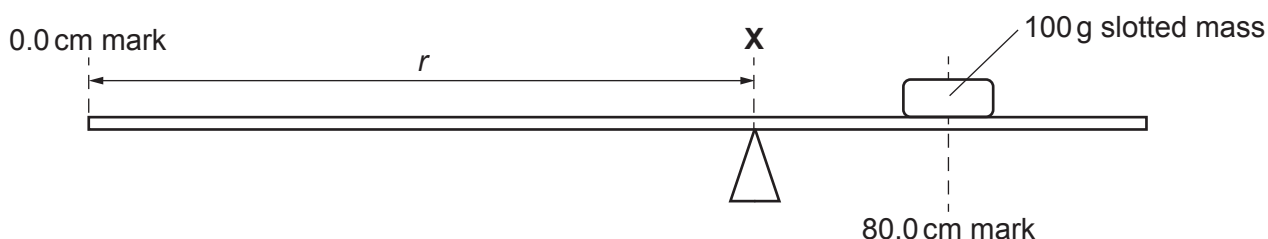


Fig. 4.1

3. The triangular block or prism must be placed on the bench next to the metre rule.
4. The metal rod must be approximately 15 cm long. One end must be clamped in the boss attached to the stand. It must be possible for the other end of the rod to overhang the edge of the bench and for it to pass through the holes in the metre rule. The metre rule must be able to swing freely from side to side without collision with the bench. A piece of brightly coloured paper e.g. a Post-it note should be placed over the tip of the rod so that it is highly visible to the candidates. A G-clamp should be used or a heavy weight should be placed on the base of the stand to prevent it from toppling.

Action at changeover

The supervisor must ensure that the metre rule is lying flat on the bench with the mass as described in Note 2. The brightly coloured paper must be placed over the tip of the metal rod as described in Note 4.

Information required by examiners

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

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)