

---

**PHYSICS**

**5054/31**

Paper 3 Practical Test

**May/June 2017**

**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.

by e-mail      info@cie.org.uk  
by phone      +44 1223 553554  
by fax        +44 1223 553558

---

This document consists of **8** printed pages.

## 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,  $0^\circ$  to  $180^\circ$  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 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.

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

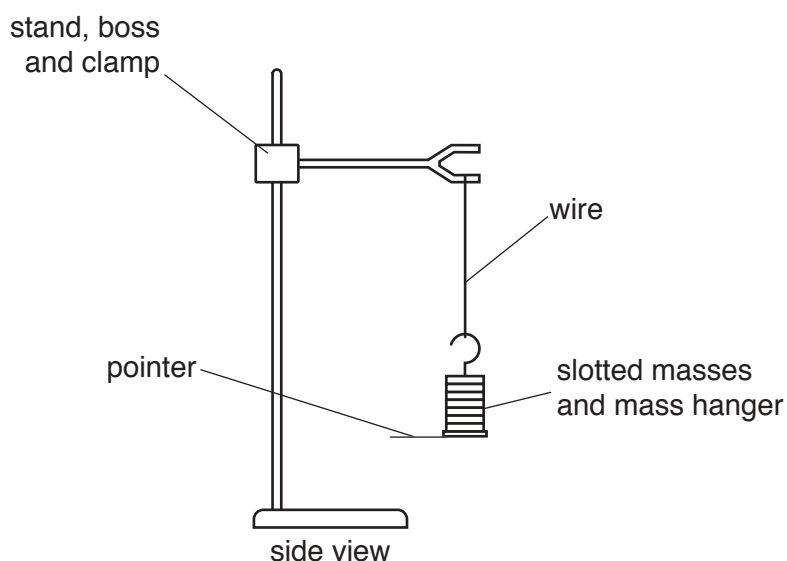
Length of wire (see Note 1).

800 g mass with pointer (see Note 2).

Stand, boss and clamp to hold the wire and mass set.

Stopwatch to a precision of at least 0.1 s.

Safety glasses.



**Fig. 1.1**

**Notes**

1. 40 cm length of 30 swg nichrome (or similar) wire. The wire will be twisted and tied at each end so that the length between the mass hanger and the clamp is 30 cm.
2. This must consist of a 100 g mass hanger and seven 100 g slotted masses. During the experiment candidates will remove slotted masses from the mass hanger. A 10 cm wooden splint or a piece of stiff card must be taped to the bottom of the mass hanger to act as a pointer. The rotation of the pointer must not be impeded by the stand.
3. Supervisors should set up the apparatus shown in Fig. 1.1 with the mass hanging on the wire just above the base of the stand, with the mass at rest.
4. At the changeover the Supervisor should restore the apparatus to the configuration shown in Fig. 1.1 with all the slotted masses on the mass hanger.

**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).**

Lamp, in a lamp holder with connecting leads (see Note 1).

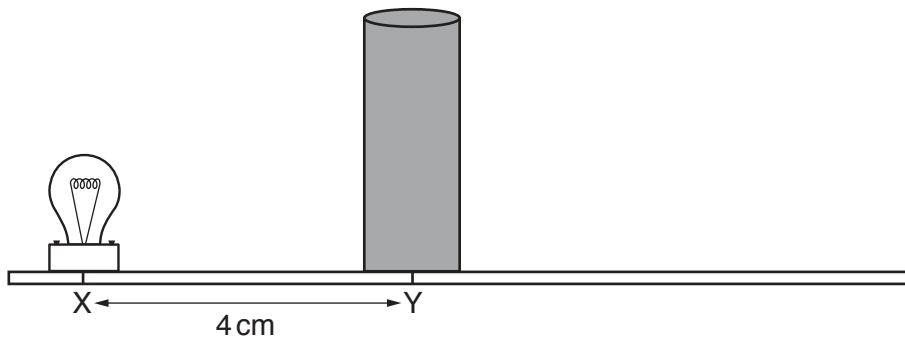
Power supply (see Note 2).

Opaque cylindrical object (see Note 3).

30 cm ruler with a mm scale.

### Notes

1. Small torch lamp of approximate diameter 1 cm, e.g. 2.5 V, 250 mA, clear filament indicator lamp (e.g. RS 106-313). This must be placed in a small holder e.g. RS 171-2503 so that the filament of the bulb is less than 5 cm above the bottom of the base and the base has a diameter of less than 7 cm. The lamp and holder must be placed on the bench as in Fig. 2.1.



**Fig. 2.1**

2. Any power supply capable of operating the lamp at its normal running voltage.
3. A wooden dowel of length at least 6 cm and diameter between 1.5 cm and 2.0 cm. The cylinder must be able to stand vertically on the bench without toppling. The cylinder will cast a shadow so the experiment must be performed in a darkened part of the laboratory.
4. At the changeover the Supervisor should ensure that the lamp is still working and that the 30 cm ruler and the cylinder are still present.

### 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)**

D.C. power supply set to 5 V (see Note 1).

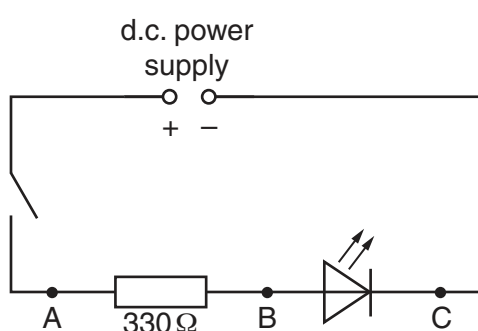
Switch or plug key.

Resistor of resistance  $330\ \Omega$  (see Note 2).

Connecting leads to enable the circuit shown in Fig. 3.1 to be set up (see Note 2).

Light-emitting diode (LED) (see Note 2).

Voltmeter with two connecting leads that may be connected between various points in the circuit (see Note 3).



**Fig. 3.1**

**Notes**

- The following are suitable power sources but all the candidates at the 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 or 5 V.
 If a variable d.c. power supply is used, the variable control should be taped to prevent candidates altering the output voltage. The positive terminal of the power supply should be labelled.
- The Supervisor must set up the circuit shown in Fig. 3.1. When the switch is closed the LED should light if it is connected the right way round. The resistor and LED must have suitable terminals so that the candidate can connect a voltmeter in parallel with these components. The resistor should be labelled  $330\ \Omega$ .
- The positive (+) terminal of the voltmeter should be marked with a + sign. The ends of the leads where they are connected to the voltmeter should be taped securely in place so that they cannot be removed.
- At the changeover, the Supervisor should
  - disconnect the voltmeter from the circuit,
  - ensure that the circuit shown in Fig. 3.1 is still connected 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.

**Question 4****Items to be supplied by the Centre (per set of apparatus, unless otherwise specified)**

A new 1.5 V cell or 2 V d.c. power supply capable of supplying 0.5 A.

Switch or plug key.

Ammeter, capable of reading up to 1.0 A to a precision of 0.05 A or better. An analogue or digital meter is suitable.

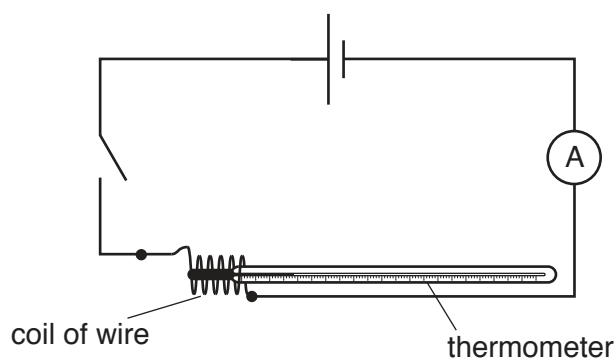
Thermometer,  $-10$  to  $100$  °C to a precision of at least  $1$  °C.

Resistance wire (see Note 1).

Stopwatch.

Two crocodile clips (see Note 2).

Connecting leads (see Note 3).



**Fig. 4.1**

**Notes**

1. A length of resistance wire should be chosen to have a resistance of about  $4\ \Omega$ . The wire should be wound around the bulb of the thermometer so that the turns of the coil do not touch each other. For example a 30 cm length of 30 swg (0.32 mm diameter) nichrome wire is suitable.

2. Crocodile clips are to be used to connect the coiled resistance wire to the rest of the circuit.

The Supervisor should set up the circuit as shown in Fig. 4.1. When the switch is closed the reading on the ammeter should be at least 0.35 A.

3. The Supervisor should ensure that candidates open the switch as soon as they have finished taking their readings.

4. At the changeover the Supervisor should:

- Check that the circuit is in the configuration shown in Fig. 4.1.
- If a cell has been used, check that it still supplies at least 0.35 A when the switch is closed, and replace if necessary.
- Replace the thermometer with one that is at room temperature.

**Information required by Examiners**

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

**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 8.

- (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 4.

.....

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**

---

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at [www.cie.org.uk](http://www.cie.org.uk) after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.