

General Certificate of Education  
June 2008  
Advanced Level Examination



**PHYSICS (SPECIFICATION A)**

**PHAP/TN**

**Instructions to Supervisors**

**CONFIDENTIAL**

**OPEN ON RECEIPT**

The examination will be held on Monday 19 May 2008 1.30 pm to 3.15 pm

- It is the responsibility of the Examinations Officer to ensure that these instructions to Supervisors are given immediately to the supervisors of the practical examination.
- These instructions are provided to enable centres to make appropriate arrangements for the examination.
- These instructions explain how to set up the equipment for Question 2.
- Relevant sections of Question 2 are printed on pages 6 and 7 of this instruction booklet.
- Centres are at liberty to make any reasonable minor modifications to the apparatus which may be required for the successful working of the experiment but a note of all such modifications must be forwarded to the Examiner with the scripts. However, any such modifications must permit the experiment to be carried out in the specified manner.

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## INSTRUCTIONS TO THE SUPERVISOR OF THE PRACTICAL EXERCISES

### Preparing for the Practical Examination

- 1 The instructions and details of materials contained in this document are for the use of the Supervisor and **are strictly confidential**. In no circumstances should any information concerning the content of this document, apparatus or materials be given before the examination to a candidate or other unauthorised person. After use, these *Instructions* must be kept in safe custody by the Examinations Officer until after the issue of results (in March or August as appropriate).

Using information for any purpose beyond that permitted in this document is potentially malpractice. Guidance on malpractice is contained in the JCQ document *Suspected Malpractice in Examinations and Assessments: Policies and Procedures*.

- 3 A suitable laboratory, or laboratories, must be reserved for the examination and kept locked throughout the period of preparation. Unauthorised persons not involved in the preparation for the examination must not be allowed to enter. Candidates must not be admitted until the specified time for the commencement of the examination.
- 2 The Supervisor has been granted access to some of the questions to aid the practical set up as part of these *Instructions*. The relevant questions are printed to enable the Supervisor to carry out the experimental parts of the Exercises in order to ensure that the apparatus and materials obtained are satisfactory and to seek advice from AQA if there are any problems. The remaining questions for this examination are not provided in these Instructions as it is not necessary for the Supervisor to be aware of the questions as they have no bearing on the setting up of the equipment. The *Instructions* must be returned to safe custody at the earliest possible moment after the Supervisor has ensured that all is in order.

### The Practical Examination

- 1 If a candidate is unable to perform the experiment, or is not performing it safely, the Supervisor is expected to give the minimum help required to enable the candidate to proceed. In this instance, a note bearing the candidate's name and number must be attached to the candidate's script reporting to the Examiner the extent of the help given. Any failure in the apparatus should also be reported to the Examiner. No help should be given with the analysis of the experimental data.

It is not the wish of the Examiner that a candidate should waste time because of, for example, an incorrect electrical connection. The Examiner wishes to test the candidate's ability to perform an experiment and carry out the subsequent analysis.

- 2 Details should be given to the Examiner if the apparatus or materials provided differ from those detailed in these *Instructions*. Where specific information or data about apparatus or materials is requested in these *Instructions*, it is important that it is given accurately. In some cases it may represent the only means available to the Examiner of assessing the accuracy of a candidate's work.

In case of difficulty the Supervisor should telephone the Assistant Subject Officer for A Level Physics, Philip Bridgehouse, at AQA (Manchester Office), telephone number 0161 953 1180, or email [physics-gce@aqa.org.uk](mailto:physics-gce@aqa.org.uk)

Candidates are to investigate the variation of electrical potential along a strip of conductive paper of non-uniform width, part of which is concealed from view.

**Apparatus required for each candidate:**

- a rectangle of conductive paper, length 300 mm, width 100 mm; rolls of conductive ('Teledeltos') paper are available from Philip Harris Ltd (code B6A48252, roll dimensions 737 mm  $\times$  2 m, price £16.91)
- copper foil strip to produce electrode, width 10 mm, length 125 mm
- copper foil strip to produce electrode, width 10 mm, length 95 mm
- rectangular piece of thin material on which to mount the conductive paper strip, of minimum length 320 mm, width 120 mm; the material should be such that the conductive paper can be glued to it, e.g. using paper glue, and the electrodes can be fixed to it using staples from a staple gun - suitable material could be sheet chipboard, notice-board ('Sundealla') or plywood
- two rectangular pieces of thick card or mounting board to conceal part of the outline of the conductive paper, length 320 mm, width 55 mm

*for the circuit:*

- dc power supply (see below); one, two, three, or four 1.5 V 'D' type cell(s), in holder, or regulated mains supply with emf in range up to 6.0 V is ideal
- digital voltmeter, capable of reading to 0.01 V or 0.001 V if used on 2000 mV full scale reading (most 3½ digit LCD multimeters will be suitable) – the meter should be capable of reading up to emf of supply; a probe should be connected to the positive terminal of the meter, e.g. a multimeter test probe or small screwdriver connected via a crocodile clip to an insulated lead terminating at a 4 mm round plug
- three further connecting leads terminated at both ends with 4 mm round plugs
- two crocodile clips

*additionally:*

- 300 mm perspex ruler

*tools required and additional materials for assembly*

- pencil and ruler to mark out conductive paper
- staple gun for construction
- scissors, sharp knife or scalpel for cutting conductive paper; use of cutting board recommended
- strong adhesive tape, e.g. gaffer tape
- paper glue, e.g. *Pritt Stick*

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The arrangement required is explained in the four diagrams opposite.

#### Top diagram

Cut out a rectangle of conductive paper with dimensions 300 mm × 100 mm

Using a pencil, mark out the area to be removed (areas identified in the diagram), then cut these parts out and discard.

#### Second diagram

Position the conductive paper centrally on to the baseboard and glue down or sellotape to fix the paper strip in place. Form the electrodes from sheet copper foil then position these onto the conductive paper so they are flush with the outer edges of the paper so the exposed length of the conductive paper is 280 mm. The length of the electrodes protruding over the edge of the baseboard should be about 15 mm.

Fix the electrodes in position using staples or some other method to provide good electrical contact with the conductive paper.

#### Third diagram

Position two rectangles of thick card as shown to prevent candidates from determining the outline of the conductive paper strip, so that a rectangle of conductive paper of length 280 mm and width 10 mm is visible. Fix the card into place using staples as shown.

#### Fourth diagram

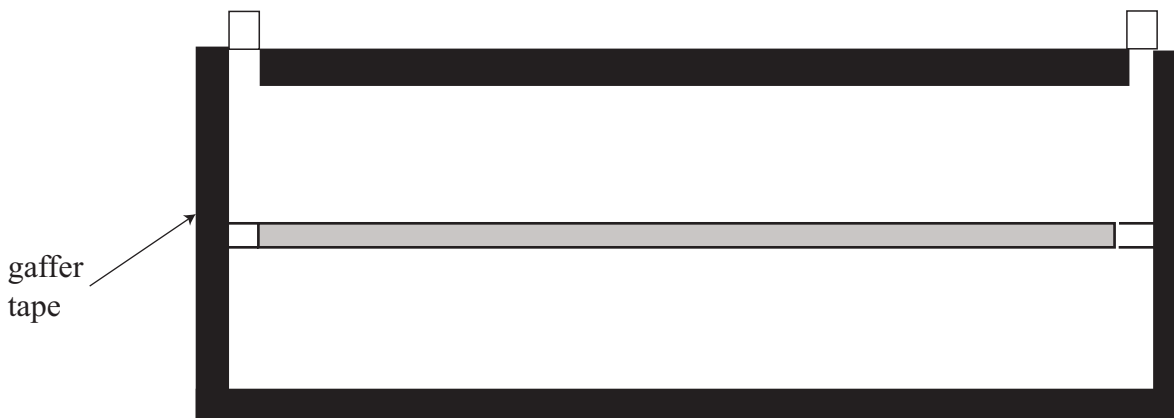
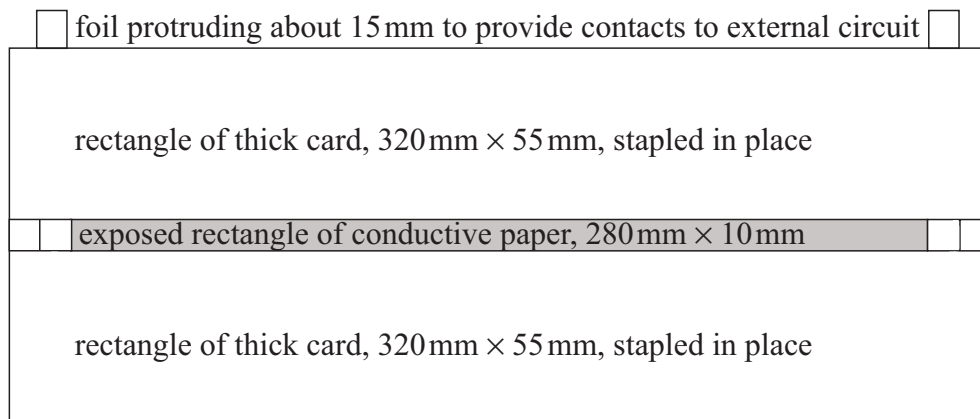
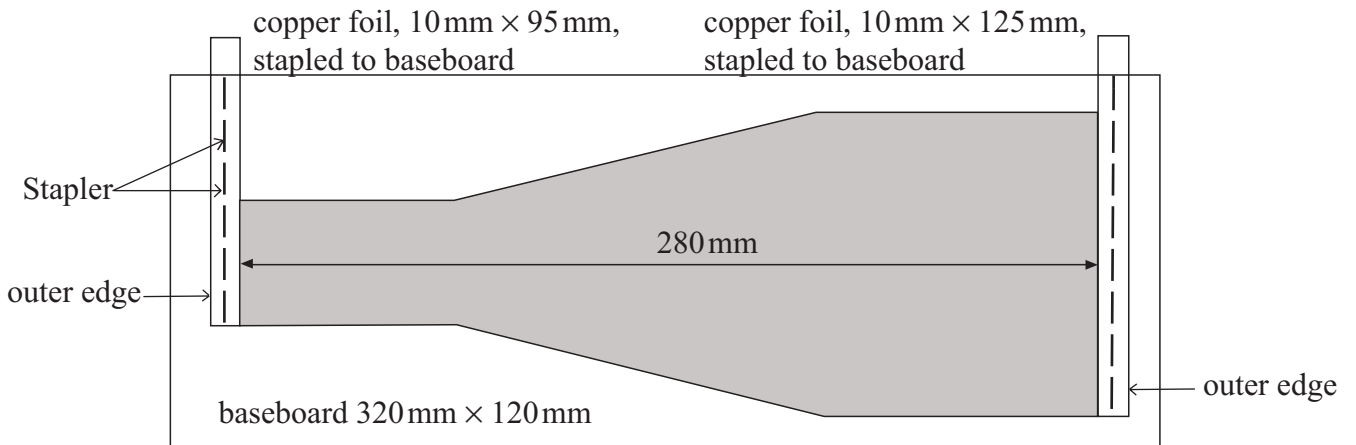
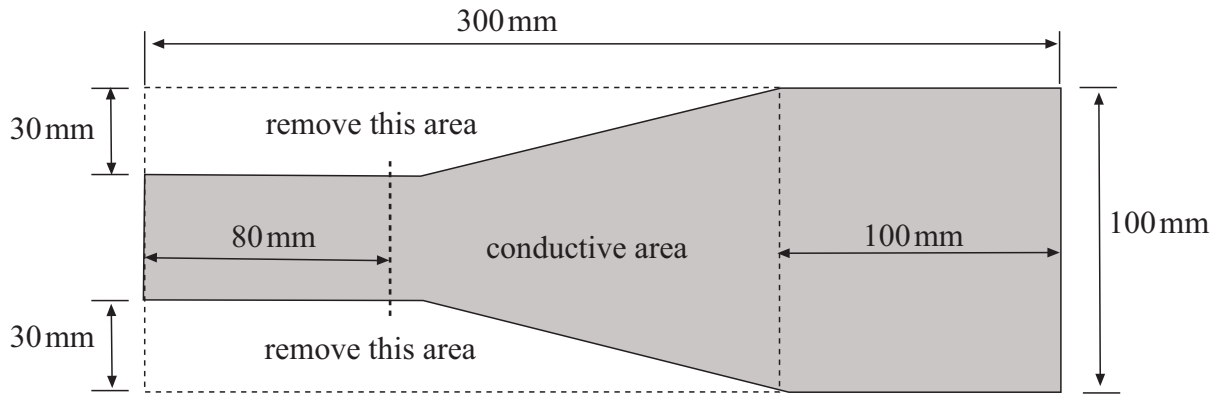
Complete the assembly by securing all the (outer) edges of the card using strong adhesive tape such as gaffer tape (note that this tape is not shown in **Figure 2** on page 6 of these instructions). Connect the external circuit as shown in **Figure 2** on page 6 of these instructions. The apparatus is now complete: details of testing given below.

Use the voltmeter to confirm that a potential gradient exists along the length of the conductive paper and not just between the copper electrodes.

Note that candidates will be required to record  $V$  for  $x$  values starting at  $x = 10$  mm and ending at  $x = 270$  mm. There is no necessity to produce apparatus for which  $V = 0$  V when  $x = 0$  mm, or  $V = \text{emf}$  of supply when  $x = 280$  mm. Thus any contact resistance at the electrodes will not affect candidates' ability to perform the experiment provided it does not change values of  $V$  should increase linearly between  $x = 10$  mm and  $x \approx 70$  mm then increase at a decreasing rate until  $x \approx 190$  mm;  $V$  should then increase linearly again until  $x = 270$  mm. The rate of change of  $V$  with  $x$  (the potential gradient) where  $x < 70$  mm should be greater by a factor of at least 2 and not more than 3 compared to that when  $x > 190$  mm.

**Examiners will require no information for this question.**

**Supervisors should be vigilant in ensuring that candidates do not tamper with the rectangles of card used to conceal the outline of the conductive paper strip.**

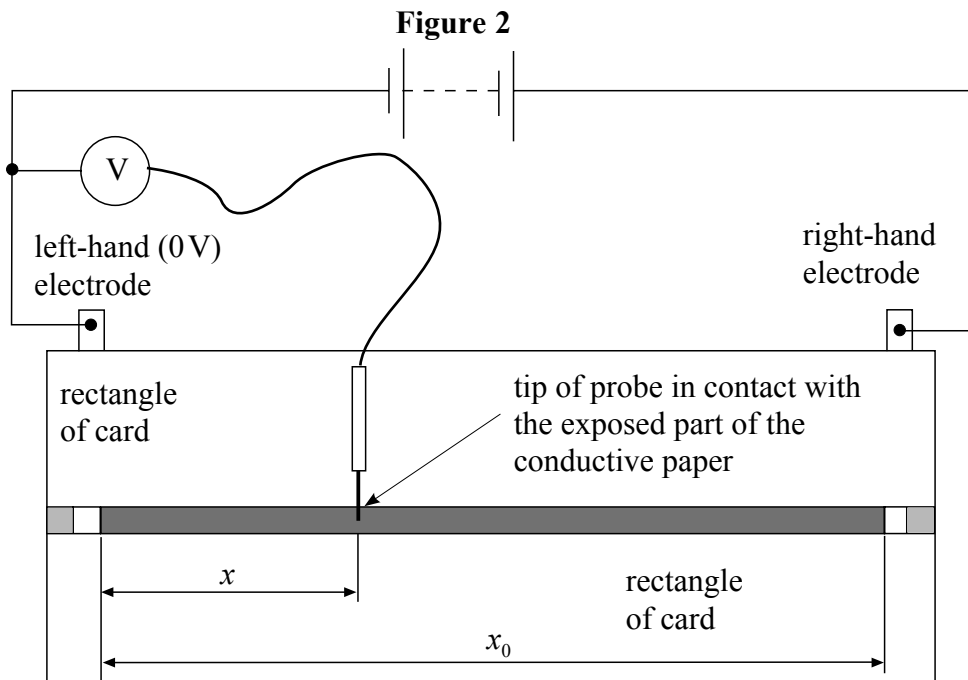


edges of card secured using strips of adhesive tape (e.g. gaffer tape)

- 2 In this experiment you are to investigate the variation of electrical potential along a strip of conductive paper, most of which is concealed from view. This strip consists of three regions; within each region, the width of the paper is either constant or varies linearly.

**Do not remove the rectangles of card concealing most of the conductive paper. No description of the experiment is required.**

You are provided with the apparatus shown in **Figure 2**.



Electrical connections are made to the conductive paper via two copper foil electrodes. A dc voltage is applied between these electrodes with the left-hand electrode at 0 V. The negative terminal of a digital voltmeter has been connected to the 0 V electrode. The positive terminal of the voltmeter is connected to a probe, the tip of which may be placed at any point on the exposed part of the conductive paper. The voltmeter reading then shows the electrical potential at a perpendicular distance,  $x$ , between the tip of the probe and the left-hand electrode.

- (a) Measure and record the distance,  $x_0$ , as shown in **Figure 2**.
- (b) (i) Place the tip of the probe in contact with the exposed part of the conductive paper at a point approximately 10 mm from the **left-hand** (0 V) electrode. Measure (and record) the electrical potential,  $V$ , and the distance,  $x$ , between the tip of the probe and the left-hand electrode.
- (ii) Place the tip of the probe in contact with the exposed part of the conductive paper at a point approximately 10 mm from the **right-hand** electrode. Measure (and record) the new readings of  $V$  and  $x$ .
- (iii) Measure (and record) additional readings of  $V$  and  $x$  by placing the tip of the probe in contact with the conductive paper at various points **between the positions** identified in (b)(i) and (b)(ii). You should take sufficient readings so that when a graph is plotted of these data, you can establish clearly how  $V$  varies with  $x$  in each of the three regions of the strip.

- (c) Plot a graph using all the measurements made in part (b) with  $V$  on the vertical axis and  $x$  on the horizontal axis.

**END OF QUESTIONS**

**The remaining questions for this examination are not provided. It is not necessary for the Supervisor to be aware of these questions as they do not have a bearing on the setting up of the experiment.**

**However centres are advised that the graph will consist of two straight line regions of positive gradient, separated by a region of positive, decreasing gradient.**

**There are no instructions printed on this page**