General Certificate of Education
January 2009
Advanced Subsidiary Examination

PHYSICS (SPECIFICATION A) **PHA3/P/TN**

Instructions to Supervisors for the Unit 3 Practical Examination

CONFIDENTIAL

OPEN ON RECEIPT

The examination will be held on Thursday 15 January 2009 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 Supervisor 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 page 5 and 6 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.**

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*.

2 The Supervisor has been granted access to some of the content of Question 2 to aid the practical set up as part of these Instructions. This is 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 Instructions must be returned to safe custody at the earliest possible moment after the Supervisor has ensured that all is in order.

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 examinations.

The Practical Examination

1 If a candidate is **unable to perform** any experiment, or is performing an experiment **incorrectly**, 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.

The Supervisor should not intervene in situations where the candidate is performing some aspect of the work badly or in a manner likely to obtain less than full credit.

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 that detailed in this document. 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 e-mail physics-gce@aqa.org.uk

Candidates will investigate the trajectory of a ball bearing falling under gravity.

Apparatus required for each candidate:

- two ball bearings of diameter 10 mm (1 is spare)
- stiff paper (eg drawing paper) of length 50 cm and width about 40 cm; this should be rolled into a tube of diameter about 4 cm and length 50 cm, the tube being secured using sellotape to prevent it from unrolling
- piece of card about 15 cm × 20 cm
- rectangular object such as a piece of wood of thickness 2 cm of dimensions 5 cm × 4 cm
- two metre rulers, in good condition and free from warping
- plumb bob fitted with at least 1 m of string
- large set square
- retort stand, boss and clamp to secure the tube in position; the raised end of the tube should be about 20 cm (± 2 cm) above the surface of the bench (dimension h_0 in **Figure 4** of the question)
- retort stand fitted with boss to which is inserted a suitable rigid horizontal fiducial pointer such as a 6-inch nail or similar; when placed on the floor, the height of the pointer should be set at about 20 cm above the floor, as shown in the diagram on page 5
- retort stand fitted with boss and clamp; candidates will use this to clamp one of the metre rulers vertically
- spare laboratory stool; candidates may wish to place the stand with the horizontal pointer on this in order to trace out the full trajectory of the ball bearing
- shallow tray or box to contain sand to catch the ball bearing at the end of the trajectory

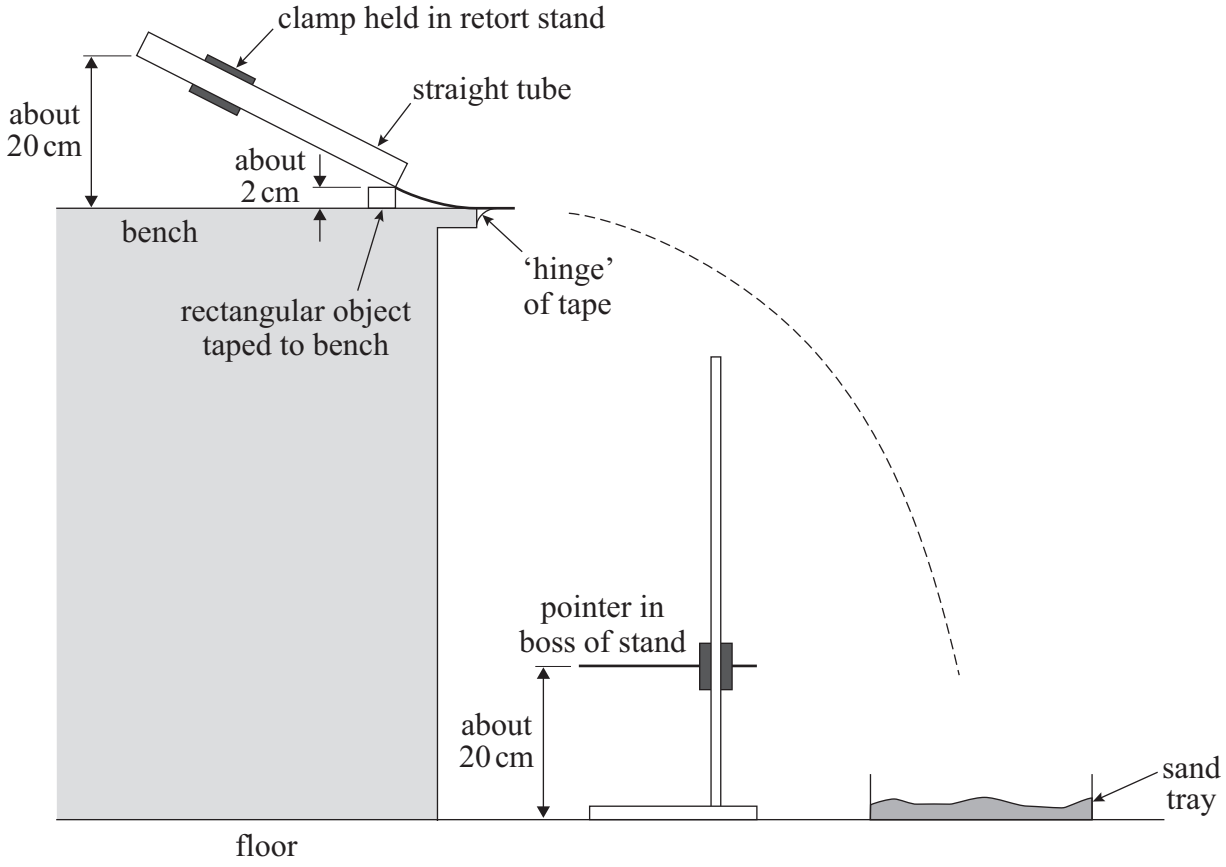
The tube should be clamped in an inclined position in a direction perpendicular to the edge of the bench. The edge of the paper in the interior of the tube should be at the top.

The card should be attached to the lower end of the tube using sellotape in order to ensure a smooth path from tube to card of a ball bearing rolled down the tube. The apparatus should be adjusted so that the card is curved gently **to the horizontal** and taped to the bench, with the end projecting by about 25 mm over the edge of the bench, as shown in the diagram on the following page. The rectangular object is used to provide additional support beneath the upper edge of the card and should be taped in position. It is suggested that a hinge of tape is used to secure the protruding part of the card to the vertical edge of the bench.

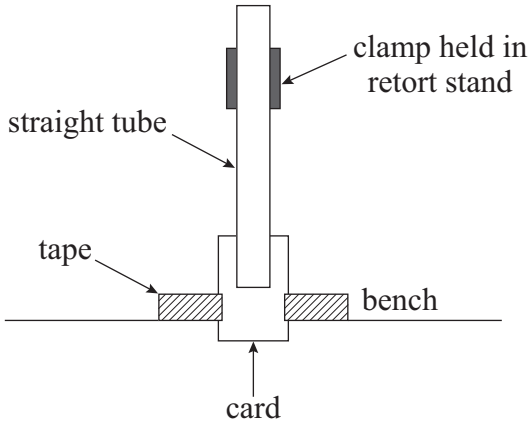
The sand tray should be placed in position on the floor to catch a ball bearing rolled from rest down the tube. Supervisors should ensure that enough free space is available in front of the bench to allow the candidate to measure the trajectory.

Candidates are instructed not to make any adjustment to the position of the tube. It may be necessary for candidates to stand the retort stand holding the pointer on a laboratory stool to make some readings.

The apparatus should now appear as shown in **Figure 4** of the question (see page 5 of these instructions.)
Check that the height of the pointer is about 20 cm above the floor.
The remaining apparatus can be positioned on the bench.
Supervisors are advised that in the event of loss, spare ball bearings should be available.



view from above

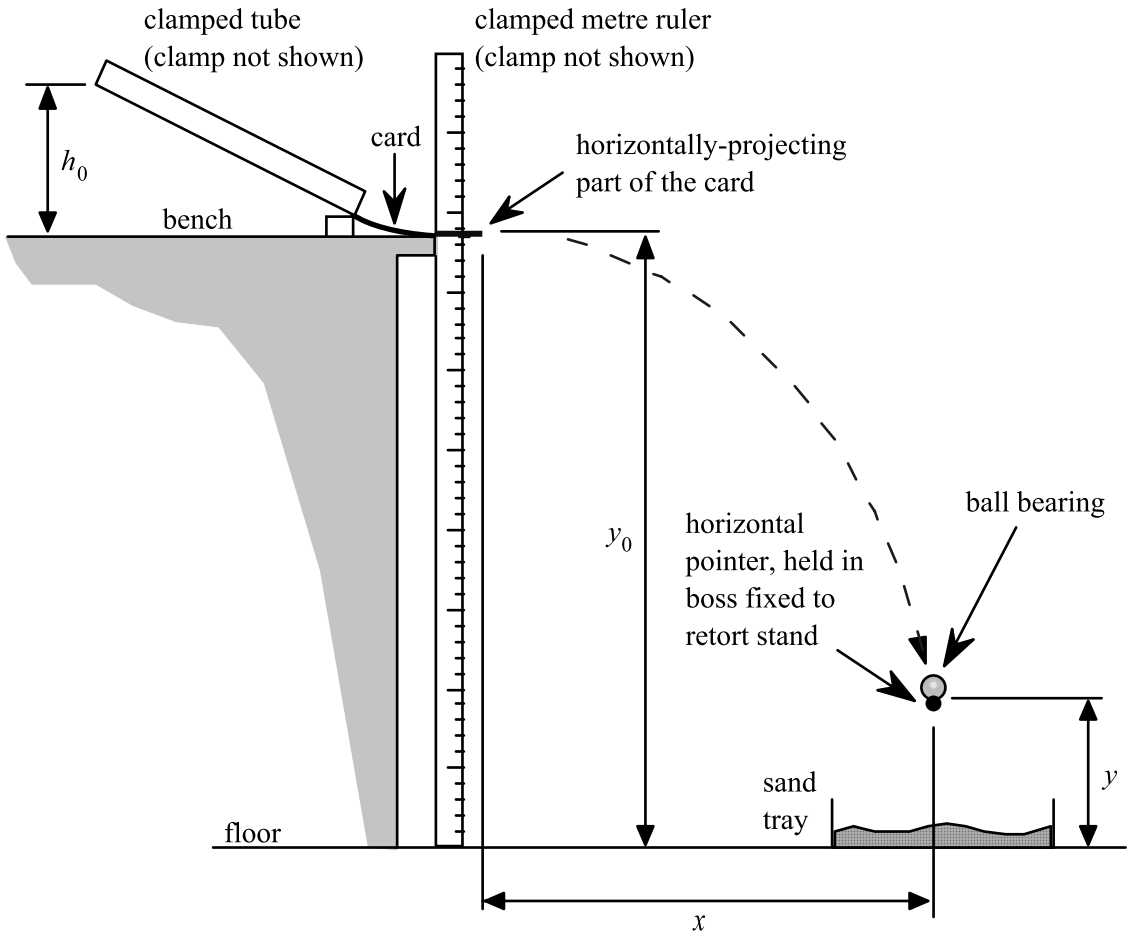


Examiners require no information for this question.

2 You are provided with a tube down which a ball bearing may be rolled.
Do not make any adjustments to the position of the tube.

Using the retort stand to which a boss and clamp are fitted, clamp a metre ruler vertically, as shown in **Figure 4**, so that the end of the ruler is in contact with the floor and the (horizontally) projecting part of the card at the lower end of the tube passes in front of the graduated face of the ruler.
The metre ruler must not obstruct the exit of the ball bearing.

Figure 4



(a) (i) Measure the vertical height, y_0, from the top surface of the (horizontally) projecting part of the card to the floor.

(ii) Measure the vertical height, h_0 as shown in **Figure 4**.

(b) Release a ball bearing from rest at the top of the tube so that it rolls straight down the tube before landing in the sand tray.

You are also provided with a horizontal pointer held in a boss fixed to a retort stand. Arrange the stand so that the direction of the horizontal pointer is parallel to the edge of the bench then adjust the position of the stand until the ball bearing, when released as before, strikes the pointer, as shown in **Figure 4**.

Use the clamped metre ruler to measure the vertical distance, y, from the top surface of the pointer to the floor. (You may move the sand tray to make this measurement.)
Use the additional metre ruler to measure the corresponding horizontal distance, x, from the pointer to the point of projection of the ball bearing, as shown in **Figure 4**.

Repeat this procedure to find additional values of x corresponding to **four** larger values of y. Record your data below.
Note that it may be necessary to place the retort stand on a laboratory stool in order to cover the whole trajectory of the ball bearing.

(c) Plot a graph with $(y_0 - y)$ on the vertical axis and x^2 on the horizontal axis.
Tabulate below the data you will plot on your graph.

(d) Measure and record the gradient, G, of your graph.

The remaining questions for this examination are not provided in the *Instructions to Supervisors*. It is not necessary for the supervisor to be aware of the questions as they have no bearing on the setting up of the experiment.

However, centres are advised that in this experiment, the graph produced should be a straight line of positive gradient.

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