General Certificate of Education
January 2003
Advanced Subsidiary Examination

AQA

ASSESSMENT and
QUALIFICATIONS
ALLIANCE

PHYSICS (SPECIFICATION A)   **PHA3/PTN**

Instructions to Supervisors for the Unit 3 Practical Examination

CONFIDENTIAL

OPEN ON RECEIPT

The examination will be held on Tuesday 21 January 2003   Morning Session

■ **These *Instructions* are provided to enable centres to make appropriate arrangements for the examination. Copies of the *Instructions* are to be kept at the centre under lock and key when not in use; they are not to be removed from the centre. The question paper packets must not be opened prior to the examination.**

■ **These instructions explain how to set up the equipment for Question 2.**

■ **Question 2 is printed on pages 3 and 4 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.**

Candidates are required to balance a metre ruler on a prism.

Apparatus required for each candidate:

☐ wooden metre ruler, free of warping and otherwise in generally good condition
☐ rubber stopper, mass to be between 30 g and 50 g marked "S", with loop of thread attached to allow candidates to suspend it from the ruler
☐ 200 g mass, value concealed, marked "M", with loop of thread attached to allow candidates to suspend it from the ruler
☐ prism to provide support for ruler
☐ rectangular block of wood, dimensions $100 \times 70 \times 40$ mm: the prism is to be placed on this to raise it (100 mm) above the level of the bench
☐ retort stand rod with boss attached fitted with a clamp, the jaws of which are set to restrict the movement of one end of the ruler when it is balanced, as shown in figure 1 of the question
☐ postcard or similar on which should be printed the mass, *S*, of the rubber stopper

Place the apparatus on the bench. No assembly is required beforehand.

Candidates will require the following information:
● the mass of the rubber stopper to ± 0.1 g,
This should be determined before the examination and printed on a postcard that should be placed in clear view for the candidates. Supervisors should remind the candidates at the end of the examination that this information should be copied in to their answer booklets at the appropriate points.

2 **This question is divided into parts (a) to (f) printed on pages 9-12.**

(a) Arrange the metre ruler, prism and wooden block as shown in **Figure 1**.
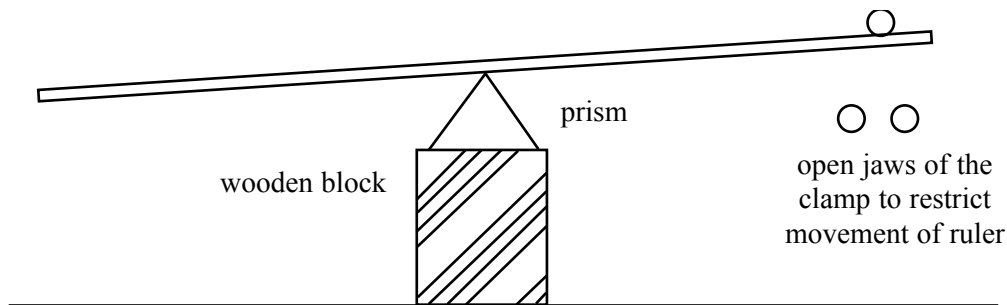Use the open jaws of the clamp to restrict the movement of one end of the ruler.

prism

wooden block

open jaws of the
clamp to restrict
movement of ruler

Figure 1

Adjust the position of the ruler until it is balanced horizontally on the prism.
Locate and record the position of the centre of mass of the ruler.

Postion of the centre of mass of the ruler =   *(1 mark)*

(b) Hang the mass, M, about 5.0 cm from the left-hand end of the ruler and adjust the ruler
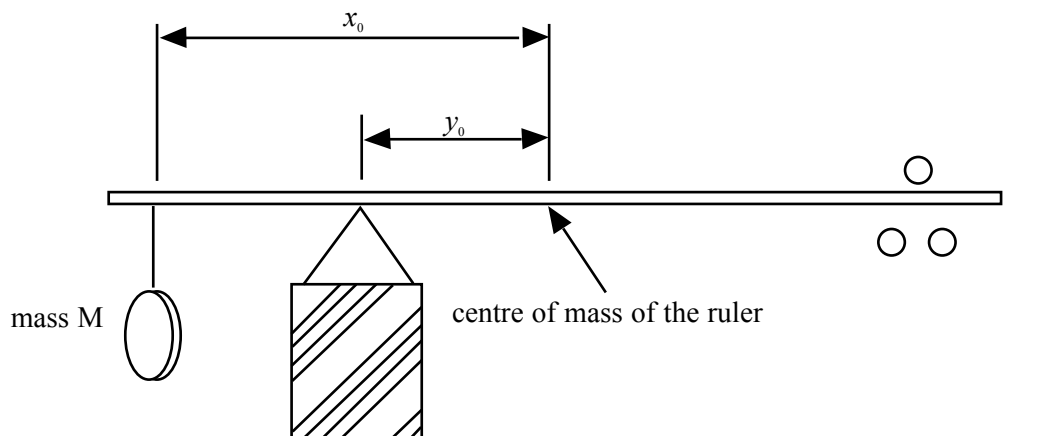until it is once again balanced as shown in **Figure 2**.

x_0

y_0

mass M

centre of mass of the ruler

Figure 2

(i) Measure and record x_0 and y_0.

(ii) Calculate the constant k, given by $k = \dfrac{y_0}{x_0}$ *(2 marks)*

Turn over ▶

(c) You are provided with the mass, *S*, of a rubber stopper. Record *S* .

Hang the stopper on the ruler on the opposite side of the pivot to mass M so that the mass and the stopper are equal distances, *x*, from the centre of mass of the ruler.
Adjust the position of the ruler until it is balanced, as shown in **Figure 3**.
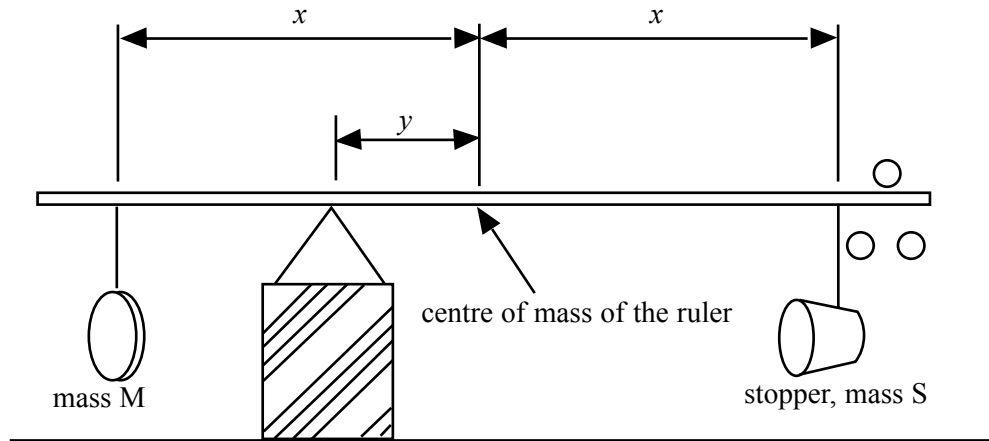

Figure 3

Investigate how *y* varies for **five** different values of *x*.
Record your measurements and observations. *(5 marks)*

(d) Using the grid, plot a graph of your results with *y* on the vertical axis and *x* on the horizontal axis. *(5 marks)*

(e) (i) Measure and record the gradient, *G* of your graph.

   (ii) Evaluate $\dfrac{k - G}{k\,(1 + G)}$. *(3 marks)*

(f) (i) State and explain which of the measurements that were made to determine *k* contain the greatest percentage error.

   (ii) By considering the arrangement shown in **Figure 2**, suggest how the mass of M should compare with the mass of the ruler to reduce the percentage error in *k*.

   (iii) Explain what determined your choice of additional values of *x*. *(6 marks)*