P510/3
PHYSICS
Paper 3
Nov./Dec. 2025
3¼ hours

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Advanced Certificate of Education

PHYSICS

Paper 3
(Practical)

3 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

This paper consists of **three** *questions.*

Answer **Question 1** *and* **one** *other question.*

Any additional question answered will **not** *be marked.*

You are **not** *allowed to use the apparatus for the first* **fifteen** *minutes. This time is to enable you read the question paper and make sure you have all the apparatus you may need.*

You are expected to record on your scripts in **blue** *or* ***black*** *ink all your observations as these observations are made, and to plan for the presentation of the records so that it is* **not** *necessary to make a fair copy of them. The working of the answers is to be handed in. Any work done in pencil* **except** *graphs will* **not** *be marked.*

Marks are given mainly for a clear record of the observations actually made, for their suitability, accuracy and for the use made of them.

Details on the question paper should not be repeated in the answer, nor is the theory of the experiment required unless specifically asked for. However, you should record any special precautions you have taken and any particular feature of the method of going about the experiment.

For each question, you will be required to select suitable apparatus from the equipment provided.

Graph paper is provided.

Mathematical tables and silent non-programmable scientific calculators may be used.

1. In this experiment you will determine the constants, m_0 and α of a pendulum bob.

PART 1

(a) Balance the metre rule *AB* provided on a knife edge with its graduated face upwards.

(b) Note the balance point, *C* and record its distance, *d* from end *A*.

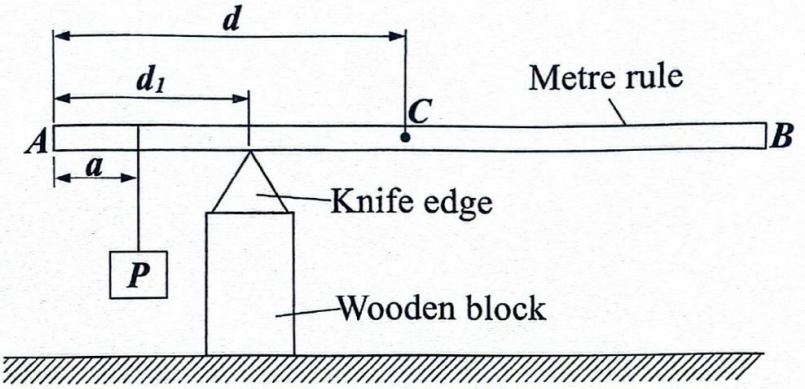

Fig. 1.1

(c) Suspend mass, $P = 0.050$ kg at a distance, $a = 10$ cm from end *A* of the metre rule.

(d) Adjust the position of the knife edge until the metre rule balances horizontally as shown in figure **1.1**.

(e) Measure and record the distance, d_1 of the knife edge from end *A*.

(f) Calculate the constant, **m**, of the metre rule from the expression:

$$\mathbf{m} = \frac{0.05\,(d_1 - a)}{(d - d_1)}$$

PART II

(a) Measure and record the diameter, d of the pendulum bob provided, in metres.

(b) Suspend a pendulum bob at a distance, $z = 5.0$ cm from end A of the metre rule AB.

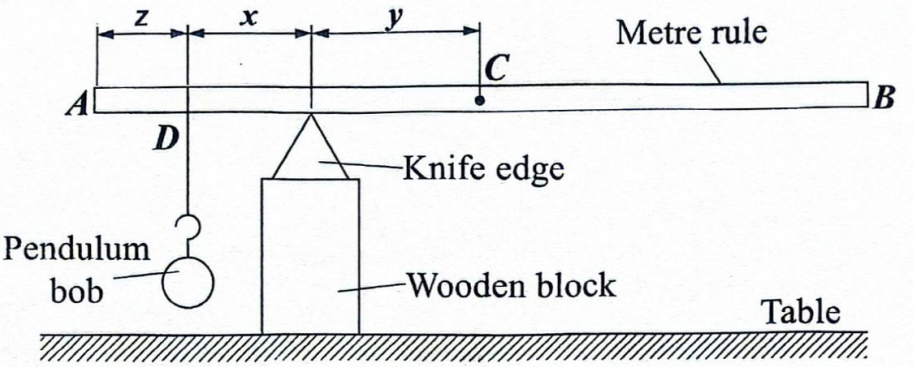

Fig. 1.2

(c) Balance the metre rule on the knife edge with its graduated face upwards as shown in the figure **1.2**.

(d) Measure and record distances x and y of the knife edge from points D and C respectively.

(e) Repeat procedure (b) to (d) for values of z =10.0, 15.0, 20.0, 25.0 and 30.0 cm.

(f) Tabulate your results in a suitable table including values of $\frac{1}{x}$ and $\frac{1}{y}$.

(g) Plot a graph of $\frac{1}{y}$ against $\frac{1}{x}$.

(h) Find the slope, S of the graph.

(i) Calculate the constant, m_0 of the pendulum bob from the expression:

$$m_0 = \frac{m}{S}$$

(j) Determine the constant, α_1 from the expression:

$$\alpha_1 = \frac{6\,m_0}{\pi d^3}$$

PART III

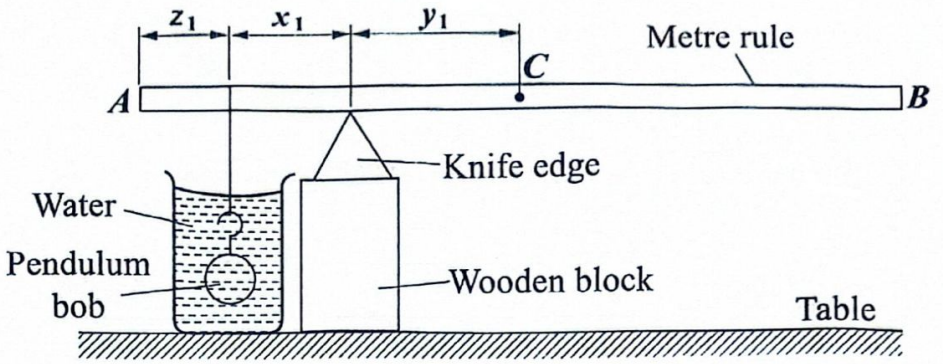

Fig. 1.3

(a) Suspend the pendulum bob at a distance, z_1 = 10.0 cm, from end *A* of the metre rule.

(b) With the pendulum bob wholly immersed in water, adjust the position of the knife edge until the metre rule balances horizontally with its graduated face upwards as shown in figure **1.3**.

(c) Measure and record the distances x_1 and y_1.

(d) Repeat procedure (a) to (c) with the pendulum bob at a distance, z_2 = 15.0 cm from end A of the metre rule and record the corresponding distances, x_2 and y_2.

(e) Calculate the constant, m_0' from the expression:

$$m_0' = m\left(\frac{x_1y_2 + x_2y_1}{2x_1x_2}\right)$$

(f) Calculate the constant, $\emptyset$ from the expression:

$$\emptyset = \frac{m_0}{m_0 - m_0'}$$

(g) Calculate the constant, α_2 from the expression:

$$\alpha_2 = 1.0 \times 10^3\, \emptyset$$

(h) Determine the constant, α of the pendulum bob from the expression:

$$\alpha = \frac{1}{2}(\alpha_1 + \alpha_2)$$

(i) State any **three** possible sources of errors in the experiment.

2. In this experiment, you will determine the constant, β of the converging lens provided.

(a) Mount the lens provided in a holder and focus a distant object outside the room onto a white screen.

(b) Measure and record the distance, $\mathbf{d}_1$ between the lens and the screen.

(c) Calculate the constant, β_1 of the converging lens from the expression:

$$\beta_1 = \frac{1}{d_1}$$

(d) Arrange a lit torch bulb, lens and the white screen in a straight line as shown in figure 2.

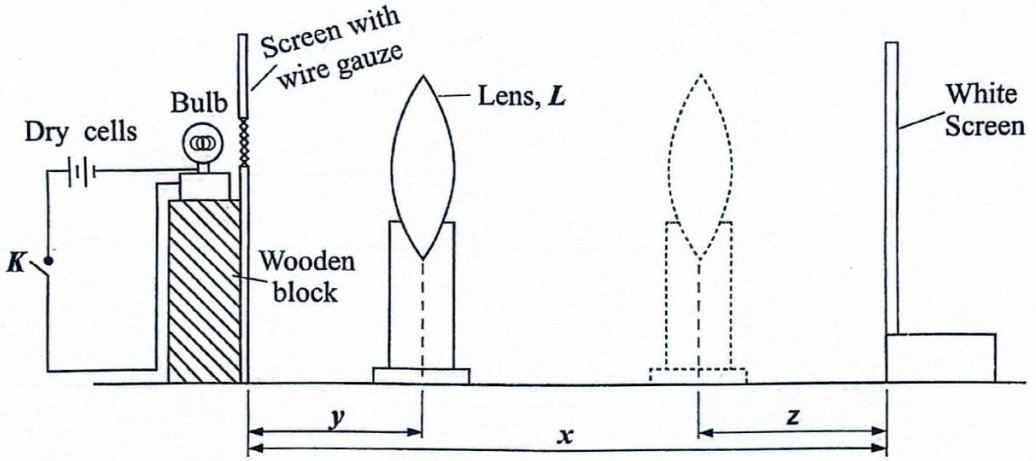

Fig. 2

(e) Adjust the distance, x between the two screens to 95.0 cm.

(f) Starting from near the screen with wire guaze, move the lens slowly towards the white screen until a sharp image is formed on it.

(g) Measure and record the distance, y between the lens and the screen with wire guaze.

(h) Keeping the screen with wire gauze and the white screen fixed, move the lens further towards the white screen until a sharp image is again formed on the white screen.

(i) Measure and record the distance, z between the lens and the screen.

(j) Repeat the procedure (e) to (i), for values of $x = 90.0, 85.0, 80.0, 75.0$ and 70.0 cm.

(k) Record your results in a suitable table including values of

$$D = [x - (y + z)] \text{ and } \frac{D^2}{x}.$$

(l) Plot a graph of x against $\frac{D^2}{x}$.

(m) Read and record the intercept , C on the vertical axis.

(n) Calculate d_2 from the expression:

$$d_2 = \frac{c}{4}.$$

(o) Calculate the constant, β_2 of the converging lens from the expression:

$$\beta_2 = \frac{1}{d_2}.$$

(p) Calculate β from the expression:

$$\beta = \frac{1}{2}(\beta_1 + \beta_2).$$

(q) State possible sources of errors and comment on the accuracy of your value.

3. In this experiment you will determine the constant, ρ_o of the dry cell **C** provided.

PART I

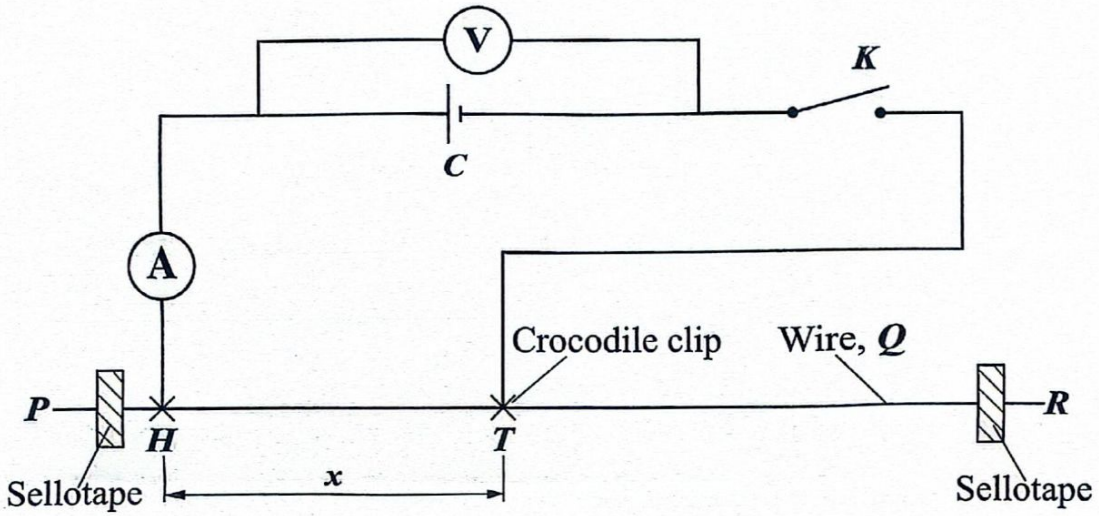

Fig. 3.1

(a) Connect the circuit shown in figure **3.1**.

(b) With switch **K** open, read and record the reading, **E** of the voltmeter.

(c) Close switch **K**.

(d) Adjust the length, x of the bare wire to 0.300 m.

(e) Read and record the values, I_o and V_o of the ammeter and voltmeter respectively.

(f) Calculate the value of r_o from the the expression:

$$r_o = \frac{E - V_o}{I_o}$$

(g) Open switch, **K**.

(h) Adjust the length, x of the bare wire to 0.700 m.

(i) Close switch, K.

(j) Read and record the ammeter reading, I_1 and voltmeter reading, V_1.

(k) Open switch, K.

(l) Calculate the value of r_1 from the expression:

$$r_1 = \frac{E - V_1}{I_1}$$

(m) Find the value, r_2 from the expression:

$$r_2 = \frac{1}{2}(r_o + r_1)$$

(n) Disconnect the circuit.

PART II

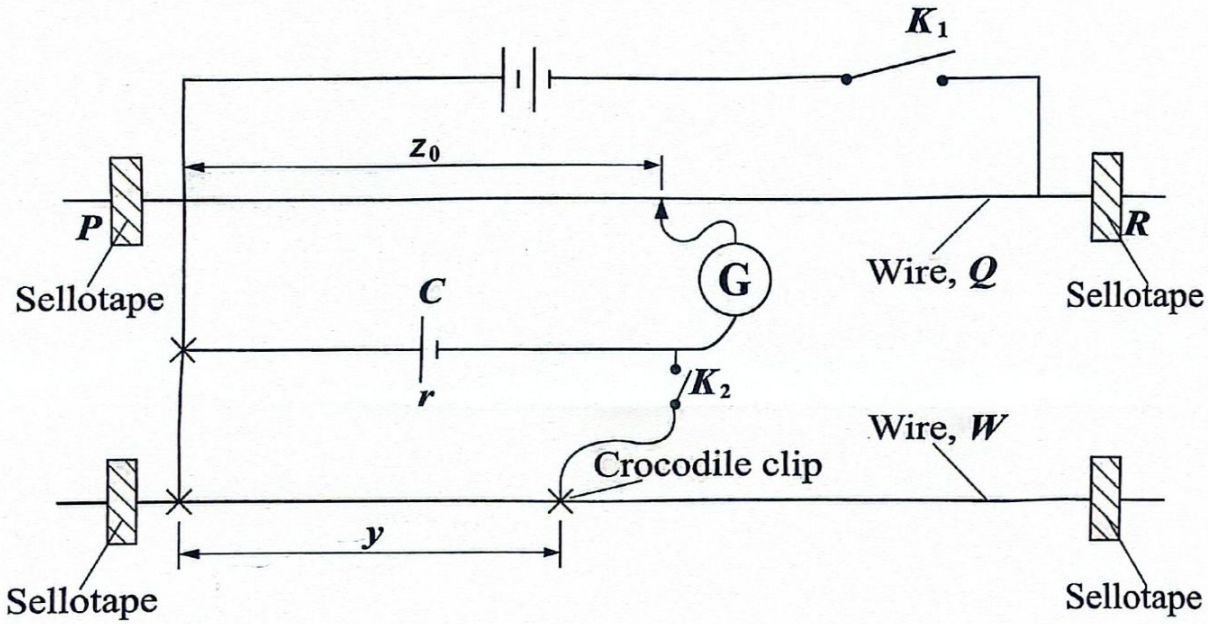

Fig. 3.2

(a) Measure the diameter, d, of wire Q.

(b) Connect the circuit as shown in figure **3.2**.

(c) With switch K_2 open and K_1 closed, locate the point on wire PR for which the galvanometer shows no deflection.

(d) Read and record length Z_o.

(e) Close switch K_2.

(f) Locate the new balance point on ***PR*** for which, y = 0.100 m.

(g) Record the balance length ***Z***.

(h) Open switches K_1 and K_2.

(i) Repeat procedure (f) to (g) when K_1 and K_2 are closed for y = 0.150, 0.200, 0.250, 0.300, 0.350 and 0.400 m.

(j) Record your results in a suitable table including values of $\frac{Z_o}{Z}$ and $\frac{1}{y}$.

(k) Plot a graph of $\frac{Z_o}{Z}$ against $\frac{1}{y}$.

(l) Determine the slope, S of your graph.

(m) Determine the value of r_3 from the expression:

$$r_3 = \frac{4\rho S}{\pi d^2}, \text{ where } \rho = 4.7 \times 10^{-7}\ \Omega\ \text{m}.$$

(n) Calculate the value of p_o from: $p_o = \frac{1}{2}(r_2 + r_3)$.

(o) State the possible sources of errors in this experiment.

END