P510/3
PHYSICS
(Practical)
Paper 3
Nov. /Dec. 2022
3¼ hours

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Advanced Certificate of Education

PHYSICS
(PRACTICAL)

Paper 3

3 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

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

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

Candidates are **not** *allowed to use the apparatus for the* **first fifteen minutes.**

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

Candidates are expected to record in their scripts in **blue** *or* **black** *ink all their 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 in pencil will* **not** *be marked.*

Marks are given mainly for a clear record of 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, candidates should record any special precautions they have taken and any particular feature of the method of going about the experiment.*

Graph paper is provided.

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

1. In this experiment, you will determine the constant α of a solid labelled Q and constant β of the liquid labelled, L. *(40 marks)*

PART 1

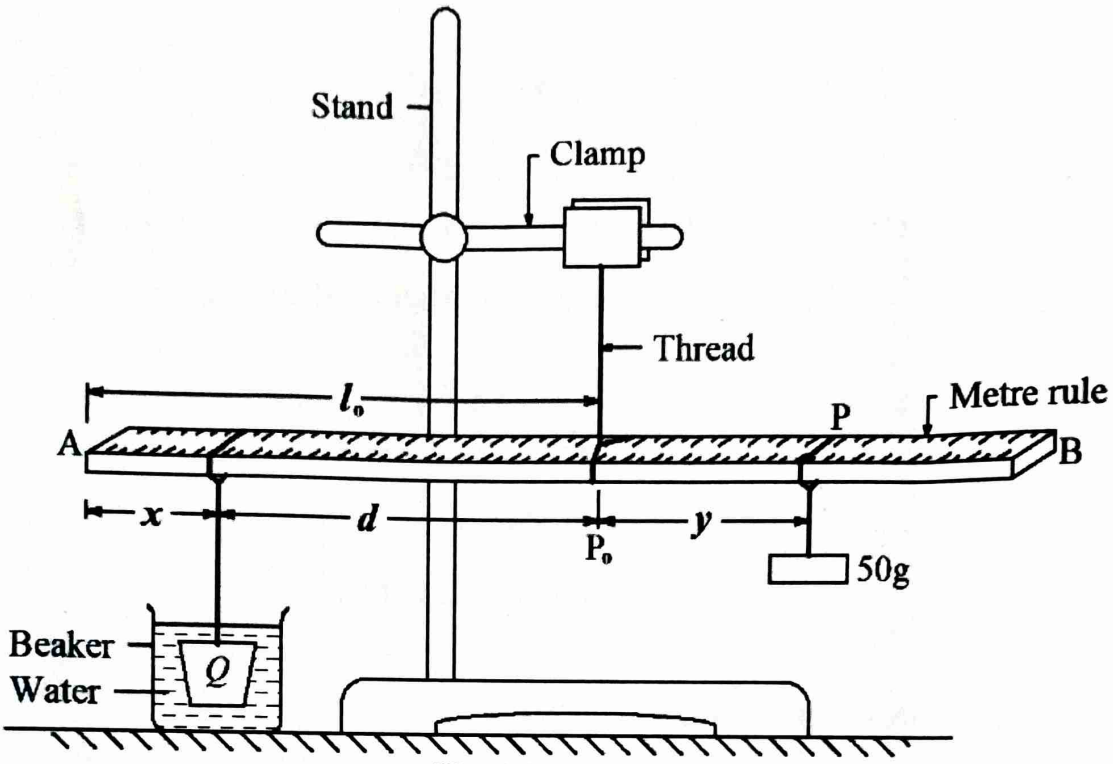

Fig. 1.1

(a) Record the mass, M of the solid Q provided.

(b) Suspend a meter rule from a clamp using a piece of thread.

(c) Adjust the metre rule until it balances horizontally.

(d) Read and record the distance l_o of the balance point, $\mathbf{P_o}$ of the meter rule from end A.

(e) Pour about 200 cm^3 of water in a beaker.

(f) Suspend the solid Q at a distance x =10.0 cm from end A of the meter rule and submerge it completely in water.

(g) Suspend a 50 g mass at a point P between $\mathbf{P_o}$ and end B of the metre rule.

(h) Adjust the position of P until the meter rule balances horizontally with Q completely immersed and not touching the beaker as shown in Figure **1.1** .

(i) Read and record distance d.

(j) Read and record distance y.

(k) Repeat procedure (f) to (j), for values of x =15.0, 20.0, 25.0, 30.0 and 35.0 cm.

(l) Tabulate your results in a suitable table.

(m) Plot a graph of y against d.

(n) Find the slope, s_1 of the graph.

(o) Calculate the constant, α of the solid Q from the expression;

$$\alpha = \frac{M}{M - 50\, s_1}.$$

PART II

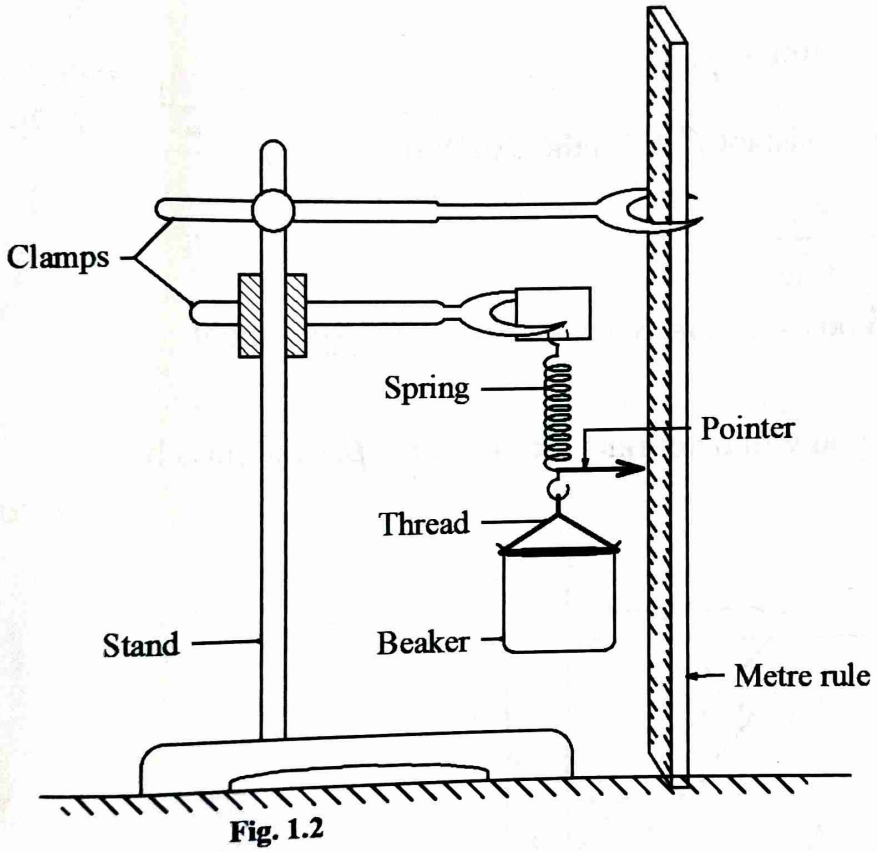

Fig. 1.2

(a) Clamp the spring provided vertically using pieces of wood.

(b) Suspend the beaker from the spring as shown in Figure **1.2**.

(c) Record the initial position, K_0 of the pointer on the meter rule.

(d) Pour 150 cm^3 of water into the beaker.

(e) Read and record the new position, K_w of the pointer.

(f) Find the extension, e_w.

(g) Repeat procedure (d) with 100 cm^3 of water.

(h) Read and record the new position, K'_w of the pointer.

(i) Find the extension, e'_w.

(j) Pour out the water and dry the beaker with a piece of tissue paper provided.

(k) Repeat procedure (b) and (c).

(l) Pour 150 cm^3 of liquid L into the beaker.

(m) Read and record the new position, K_L of the pointer.

(n) Find the extension, e_L

(o) Repeat procedure (l) for 100 cm^3 of liquid L.

(p) Read and record the new position, K'_L of the pointer.

(q) Find the extension, e'_L.

(r) Calculate the constant β from the expression;

$$2\beta = \left(\frac{e_L}{e_w} + \frac{e'_L}{e'_w}\right).$$

(s) Explain **two** possible sources of errors in the experiment.

2. In this experiment you will determine the constant, μ of a glass block provided. *(40 marks)*

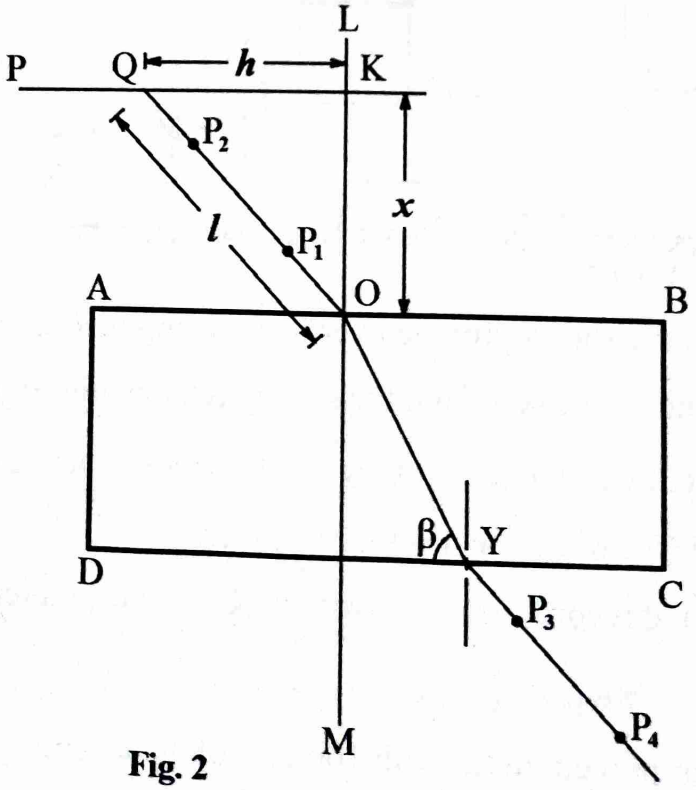

Fig. 2

(a) Fix the white plain sheet of paper on a soft board using drawing pins.

(b) Place the glass block on the paper with its broader face upwards and trace its outline ABCD.

(c) Remove the glass block and draw a normal LOM to AB at a distance of 4.0 cm from end A of the glass block as shown in Figure **2**.

(d) Measure the distance OK = x = 7.0 cm along the normal LOM.

(e) Draw a perpendicular PQK to LOM at point K.

(f) Measure distance $\boldsymbol{h}$ = 2.0 cm on line PK.

(g) Join point Q to O.

(h) Measure and record the length, $\boldsymbol{l}$.

(i) Fix pins P_1 and P_2 vertically along QO.

(j) Replace the glass block on its outline.

(k) While viewing from side DC of the glass block, fix pins P_3 and P_4 such that they appear to be in line with images of pins P_1 and P_2.

(l) Remove the glass block.

(m) Join pins P_3 and P_4 to meet DC at Y.

(n) Join Y to O.

(o) Measure and record angle β.

(p) Repeat procedure (e) to (m), for values of $\boldsymbol{h}$ = 4.0, 6.0, 8.0, 10.0 and 12.0 cm.

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

$$\frac{l^2}{h^2} \text{ and } \frac{1}{Cos^2\beta}.$$

(r) Plot a graph of $\frac{l^2}{h^2}$ against $\frac{1}{Cos^2\beta}$.

(s) Determine the slope, S, of the graph.

(t) Calculate the value of the constant μ from the expression;

$$S = \frac{1}{\mu^2}.$$

(u) Comment on the procedure and your results.

HAND IN YOUR TRACING TOGETHER WITH YOUR SCRIPT

3. In this experiment, you will determine the constant γ, of the bare wire labelled W. *(40 marks)*

PART 1

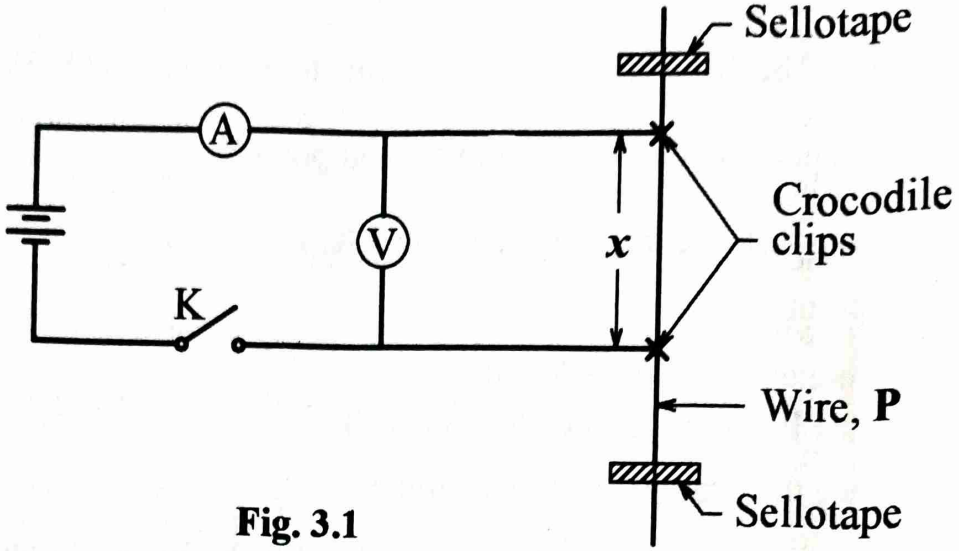

Fig. 3.1

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

(b) Adjust the length x of the wire **P** to 0.400 m .

(c) Close switch K.

(d) Read and record the ammeter reading, I and the voltmeter reading, V.

(e) Open switch K.

(f) Disconnect the circuit.

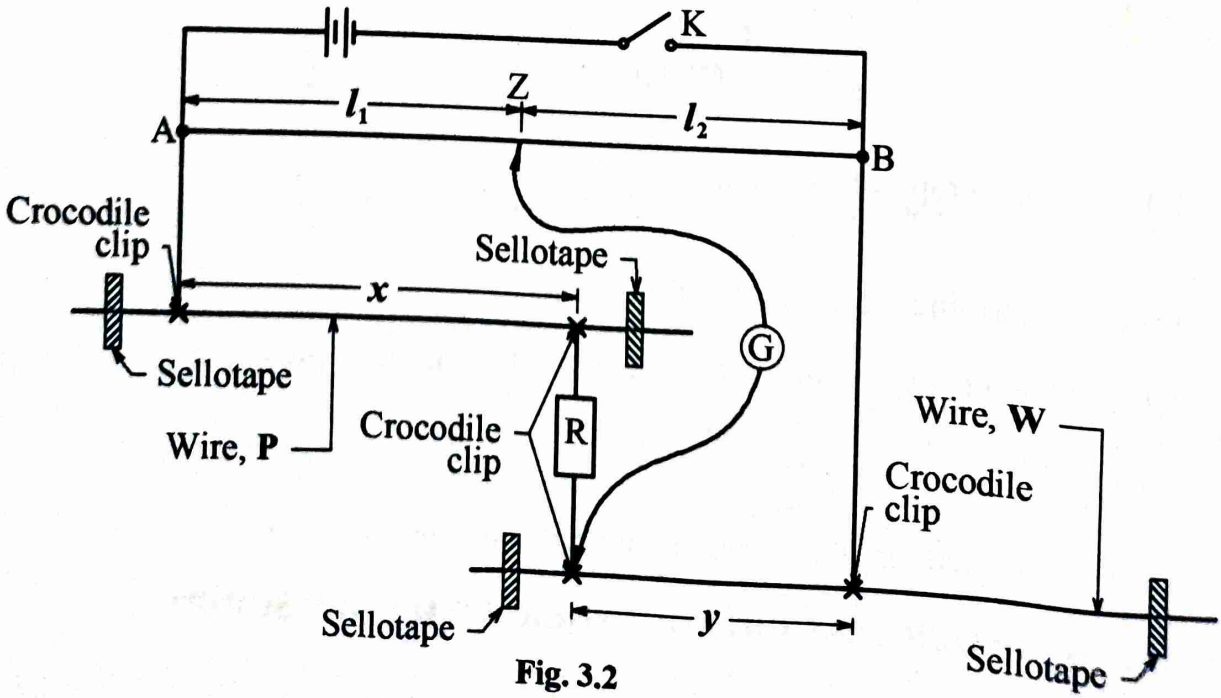

Fig. 3.2

PART II

(a) Connect the circuit shown in the Figure **3.2** with the length x of the wire P equal to 0.400 m.

(b) Adjust the length y of the wire W to 0.200 m.

(c) Close switch K.

(d) Move the sliding contact along the wire AB of the potentiometer and locate point Z for which the galvanometer shows no deflection.

(e) Read and record the balance lengths l_1 and l_2 in meters.

(f) Open switch K.

(g) Repeat the procedure (b) to (f) for values of $y = 0.300,\ 0.400,\ 0.500,\ 0.600$ and 0.700 m.

(h) Tabulate your results including values of $\frac{l_1}{l_2}$ and $\frac{1}{y}$.

(i) Plot a graph of $\frac{l_1}{l_2}$ against $\frac{1}{y}$.

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

(k) Measure and record the diameter, D, of the wire W in metres.

(l) Read and record the value of the resistor, R.

(m) Calculate the constant γ of the wire W from the expression;

$$\gamma = 0.79\, D^2 \left(\frac{V + IR}{IS}\right).$$

(n) State **six** sources of errors in the experiment.