P510/3
PHYSICS
(PRACTICAL)
Paper 3
July/August 2024
3 1/4 hours

WAKISSHA JOINT MOCK EXAMINATIONS

Uganda Advanced Certificate of Education

PHYSICS PRACTICAL

(PRINCIPAL SUBJECT)

Paper 3

3 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

- *Answer **Question 1** and **one** other question.*
- *Candidates are **not** allowed to use the apparatus for the first fifteen minutes.*
- *Graph papers are provided.*
- *Mathematical tables and non-programmable scientific electronic calculators may be used.*
- *Write on one side of the paper only.*
- *Candidates are expected to record on their answer scripts all their observations as these observations are made and to plan 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.*
- *Details on the question paper should not be repeated in the answer, nor is the theory of the experiment required unless specifically asked for. Candidates should, however, record any special precautions they have taken and any particular feature of their method of going about the experiment.*
- *Marks are given mainly for a clear record of the observations actually made, for their suitability and accuracy, and for the use made of them.*

Turn Over

QUESTION 1

In this experiment, you will determine the Young's modulus of the metre rule, provided using two methods.

Part I

(a) Measure and record the thickness, t, and the breadth, b, of the metre rule provided.

(b) Clamp the metre rule at the edge of the table with length, l = 0.800m free as shown in Figure 1.

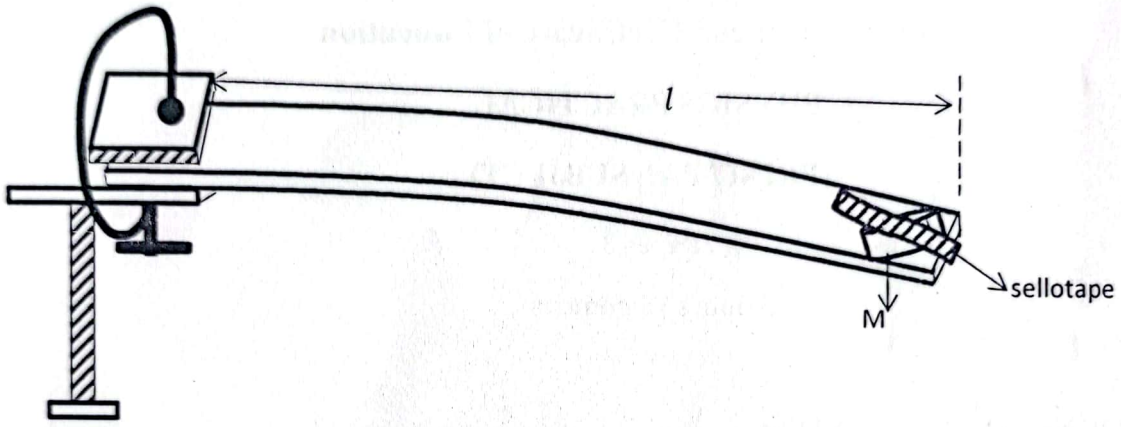

Figure 1.

(c) Stick/attach a mass M = 0.070kg at a distance 1.0cm from the free end of the metre rule using the pieces of sellotape provided as shown in Figure 1.

(d) Depress the mass, M, through a small distance and release it to oscillate.

(e) Determine the time for 20 oscillations and calculate the period, T.

(f) Repeat procedures (c) to (e) for values of M = 0.100, 0.120, 0.150, 0.170 and 0.200 kg.

(g) Tabulate your results including values of $\frac{1}{M}$ and $\frac{1}{T^2}$.

(h) Plot a graph of $\frac{1}{T^2}$ against $\frac{1}{M}$.

(i) Determine the slope, s, of your graph.

(j) Calculate Young's modulus, E_l, from the expression, $E_l = \frac{16\pi^2 l^3 s}{bt^3}$

Part II

(a) Fix a pointer at the 50.0 cm mark of the metre rule using a piece of sellotape.

(b) Place the metre rule so that it lies horizontally on the two knife edges provided as shown in Figure 2.

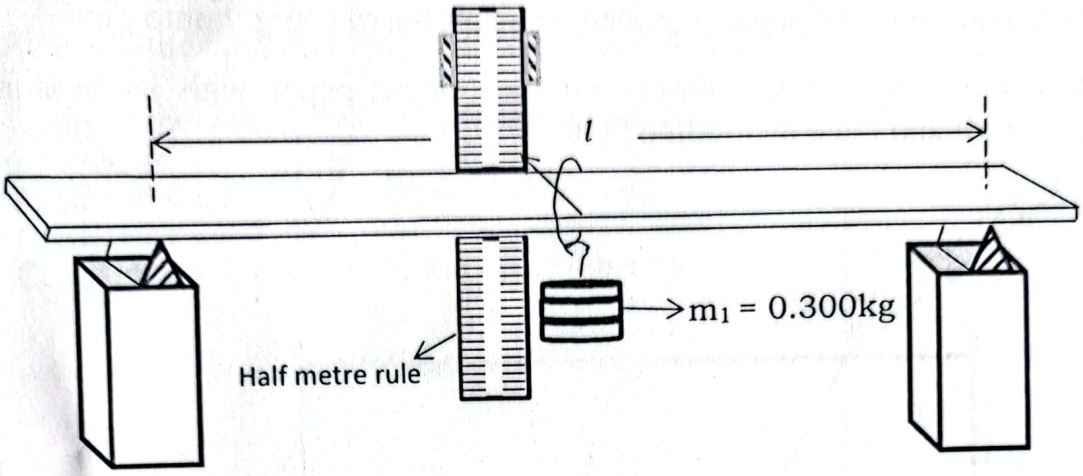

Figure 2.

(c) Clamp a half metre rule vertically and place it next to the pointer as shown in Figure 2.

(d) Adjust the knife edges such that the distance between them, $l = 0.800$m and they are equidistant from the 50.0 cm mark of the metre rule.

(e) Suspend a mass $m_1 = 0.300$ kg at the 50.0 cm mark of the metre rule.

(f) Determine the depression, y_1, of the pointer in metres, on the half metre rule.

(g) Remove the mass, m_1, from the metre rule.

(h) Repeat procedures (e) for mass, $m_2 = 0.500$ kg.

(i) Determine the depression, y_2, of the pointer in metres, on the half metre rule.

(j) Calculate the Young's modulus, E_2, of the metre rule from the expression,

$$E_2 = \frac{0.895}{bt^3}\left(\frac{m_1}{y_1} + \frac{m_2}{y_2}\right).$$

(k) Calculate the Young's modulus E of the metre rule from the expression,

$$E = \frac{1}{2}(E_1 + E_2)$$

QUESTION 2

In this experiment, you will determine the refractive index, ***n*** of the glass block provided.

(a) Measure and record the breadth, **b,** of the glass block provided.

(b) Fix a white sheet of paper provided on a soft board using thumb pins.

(c) Place the glass block centrally on the tracing paper with its broadest face uppermost and trace the outline PQRS.

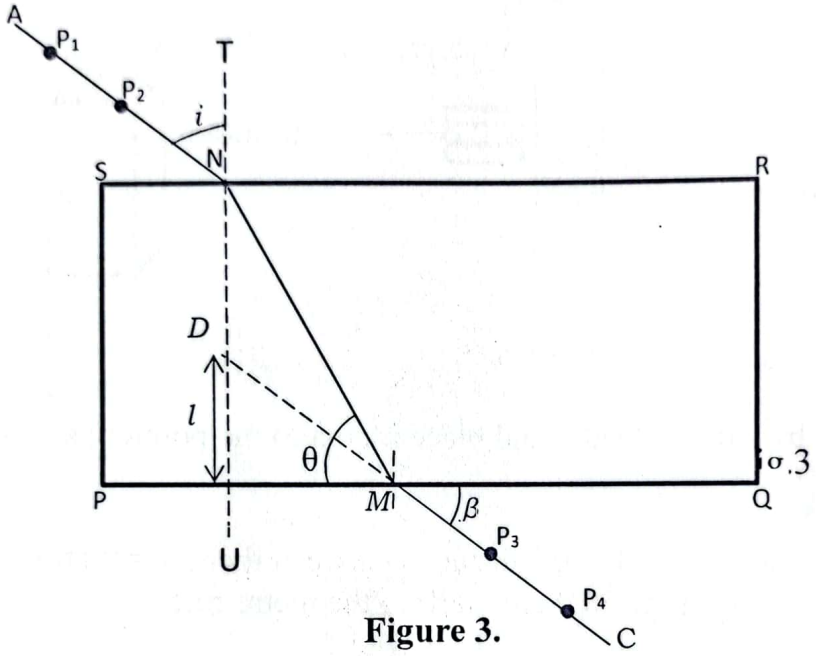

Figure 3.

(d) Draw a normal TU at N about 3.0 cm from PS.

(e) Draw a line AN, such that angle, $i = 10^0$ as shown in Figure 3 above.

(f) Replace the glass block on its outline.

(g) Fix pins P_1 and P_2 vertically along AN.

(h) Looking through the glass block from the face PQ, fix pins P_3 and P_4 such that they appear to be in line with the images of pins P_1 and P_2.

(i) Remove the glass block and the pins.

(j) Draw a line through P_3 and P_4 to meet PQ at M, and join M to N.

(k) Measure and record angles, β and θ.

(l) Produce (extend) line CM backward to meet TU at D.

(m) Measure and record distance, ***l***.

(n) Repeat procedures (e) to (m) for values of, $i = 20^0, 30^0, 40^0, 60^0$ and 65^0.

(o) Tabulate your results including values of sin *i* and $x = \dfrac{l \sin\theta}{b \tan\beta}$

(p) Plot a graph of **sin *i*** against ***x***.

(q) Find the slope, **n** of the graph.

NB: ***HAND IN THE TRACING PAPER***

QUESTION 3

In this experiment, you will determine the resistivity, ρ of the material of the wire provided.

Part I.

(a) Measure the diameter, d of the bare wire provided, labelled W.

(b) Connect the voltmeter across the terminals of the cell marked, E.

(c) Read and record the voltmeter reading, V_0.

(d) Connect the circuit shown in Figure 4 below.

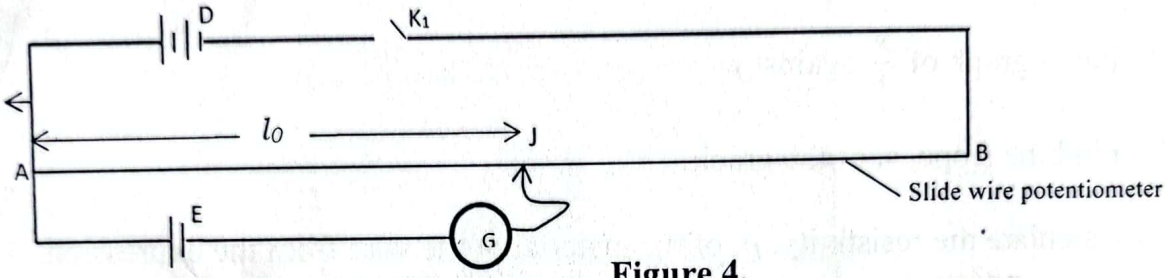

Figure 4.

(e) Close switch K_1 and move the sliding contact J along the wire AB to locate a point on it, for which galvanometer, G, shows no deflection.

(f) Measure and record the balance length l_0.

(g) Find the value, α from the expression, $\alpha = \frac{V_0}{l_0}$

Part II.

(a) Fix the bare wire, W, provided on a metre rule using sellotape.

(b) Connect the circuit as shown in the Figure 5 below, with length of wire, W, PQ = 100 cm

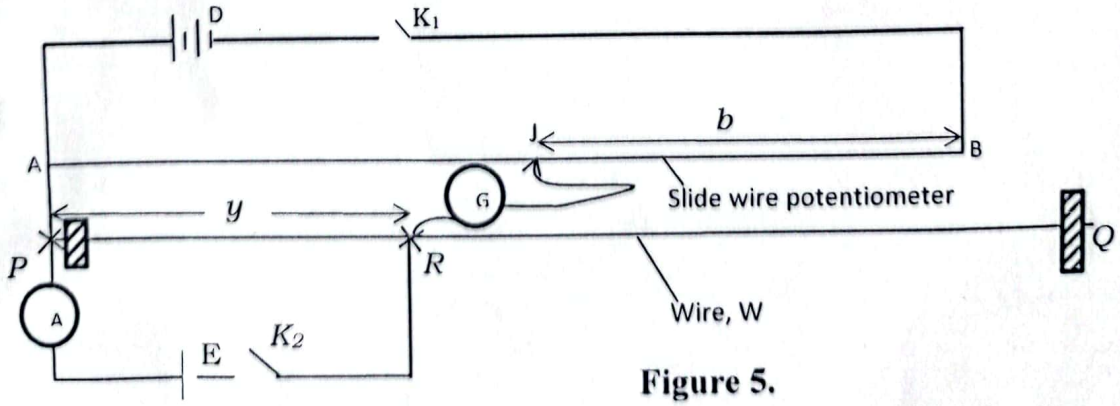

Figure 5.

(c) Starting with length, $y = 0.300$ m of the bare wire W.

(d) Close switches K_1 and K_2.

(e) Record the ammeter reading, I.

(f) Move the sliding contact, J, along the potentiometer wire until a point is found where the galvanometer, **G**, shows no deflection.

(g) Measure and record the balance length, b.

(h) Open switches K_1 and K_2.

(i) Repeat procedures (c) to (h) for values of, y = 0.400, 0.500, 0.600, 0.700 and 0.800 m.

(j) Tabulate your results including values of x and $\frac{x}{I}$; where $x = (1 - b)$.

(k) Plot a graph of $\frac{x}{I}$ against y.

(l) Find the slope, **s**, of the graph.

(m) Calculate the resistivity, ρ, of the material of the wire from the expression,

$$\rho = \frac{\pi d^2 \alpha s}{4}$$

(n) State two possible sources of errors in the experiment.

END