P510/3

PHYSICS

Paper 3

3 ¼ Hours

BUIKWE DISTRICT JOINT MOCK EXAMINATIONS BOARD (BUSSHA)

MOCK EXAMINATIONS 2024

Uganda Advanced Certificate of Education

PHYSICS

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 or write for the first fifteen minutes.*
- *Graph papers are provided.*
- *Mathematical tables and silent non – programmable calculators may be used.*
- *Candidates are expected to record on their scripts all the observations as these observations are made and 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 precaution they have taken and any particular feature of their methods of going about the experiment.*
- *Marks are given mainly for clear record of the observations actually made, for their suitability and accuracy, and for the use made of them.*

1. **In this experiment you will determine the constant, β and the Young's modulus E of the material of a bicycle spoke.** ***(40marks)***

PART I

(a) Measure and record the mass, **M**, of the bicycle spoke.

(b) Suspend the bicycle spoke provided horizontally using the two threads as shown in figure 1.

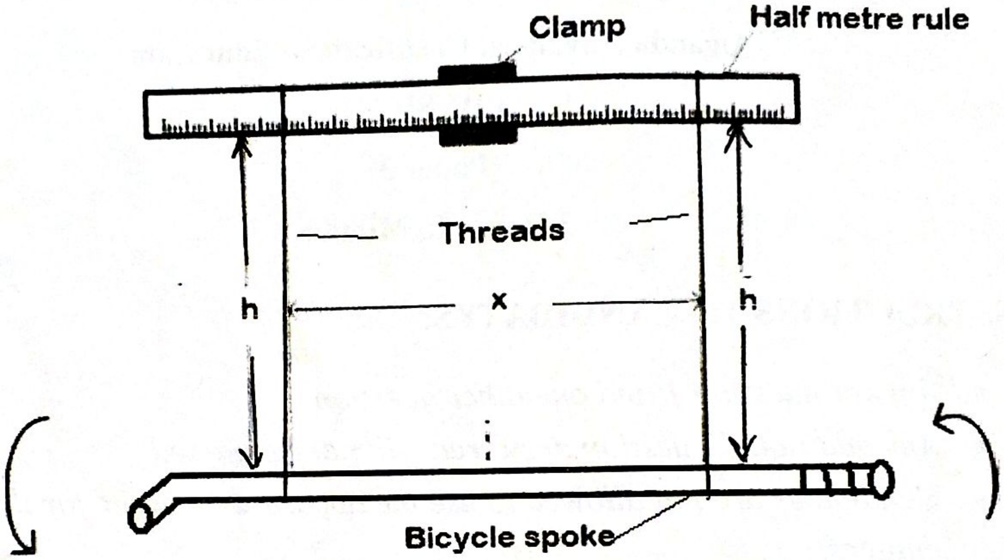


Figure 1

(c) Adjust the pieces of thread such that the distance x between them is 20.0 cm, and they are equidistant from the centre of the spoke.

(d) Keeping the pieces of thread parallel, adjust them so that the length $h = 0.150$ m.

(e) Displace the ends of the spoke horizontally through a small angle and release it such that it oscillates about the vertical axis.

(f) Measure and record the time for 20 oscillations.

(g) Determine the period T.

(h) Repeat procedures from (d) to (g) for values of $h = 0.200, 0.250, 0.300, 0.350$ and 0.400m.

(i) Tabulate your results including values of T^2.

(j) Plot a graph of T^2 against h.

(k) Determine the slope S of your graph.

(l) Calculate the constant β from the expression: $S = \frac{16\pi^2\beta}{Mgx^2}$

Where $g = 9.81 ms^{-2}$.

PART II

(a) Measure and record the diameter, d, of the bicycle spoke provided.

(b) Clamp the spoke horizontally between two pieces of wood with a length $L = 0.200$m projecting from the edge of the table.

(c) Attach a pointer using a paper clip to a piece of thread and suspend it about 1.0cm from the free end of bicycle spoke as shown in figure 2.

(d) Clamp a metre rule vertically and place it next to the pointer on the bicycle spoke.

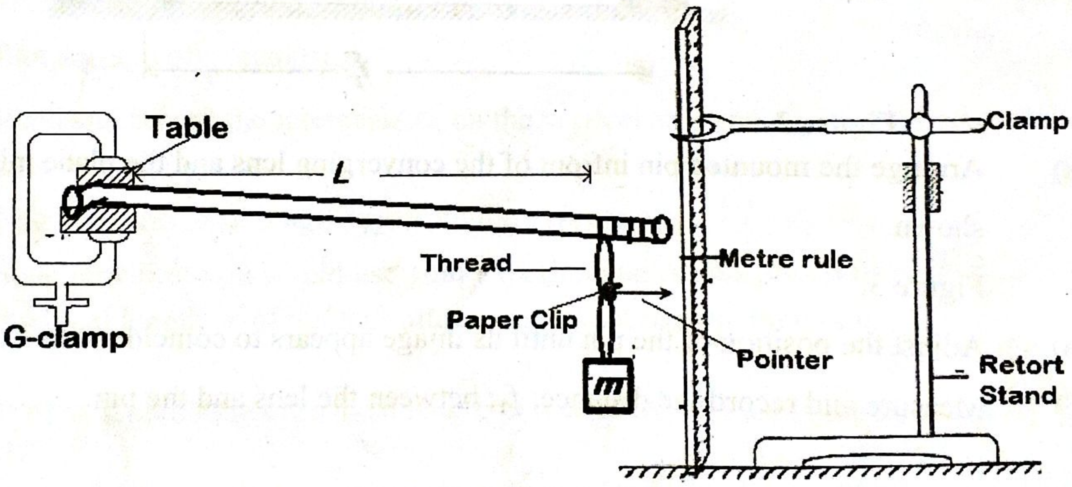


Figure 2

(e) Read and record the position of the pointer on the metre rule.

(f) Suspend a mass $m = 0.100$ kg from the pointer.

(g) Read and record the new position of the pointer on the metre rule.

(h) Determine the depression x of the spoke in metres.

(i) Calculate Young's modulus **E** from the expression:

$$E = \frac{32\, g\, L^3 m}{3\, \pi d^4 x}.$$

Where $g = 9.81 ms^{-2}$.

(j) Why do we repeat the procedure in part I?

(k) How would you obtain an accurate value of Young's modulus.

2. In this experiment, you will determine the focal length, f, of a converging lens L using two methods. ***(40marks)***

METHOD I

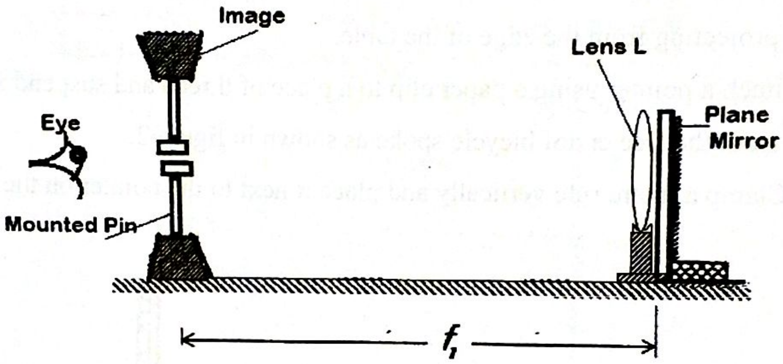


Figure 3

(a) Arrange the mounted pin infront of the converging lens and the plane mirror as shown Figure 3.

(b) Adjust the position of the pin until its image appears to coincide with it .

(c) Measure and record the distance, f_1, between the lens and the pin.

METHOD II

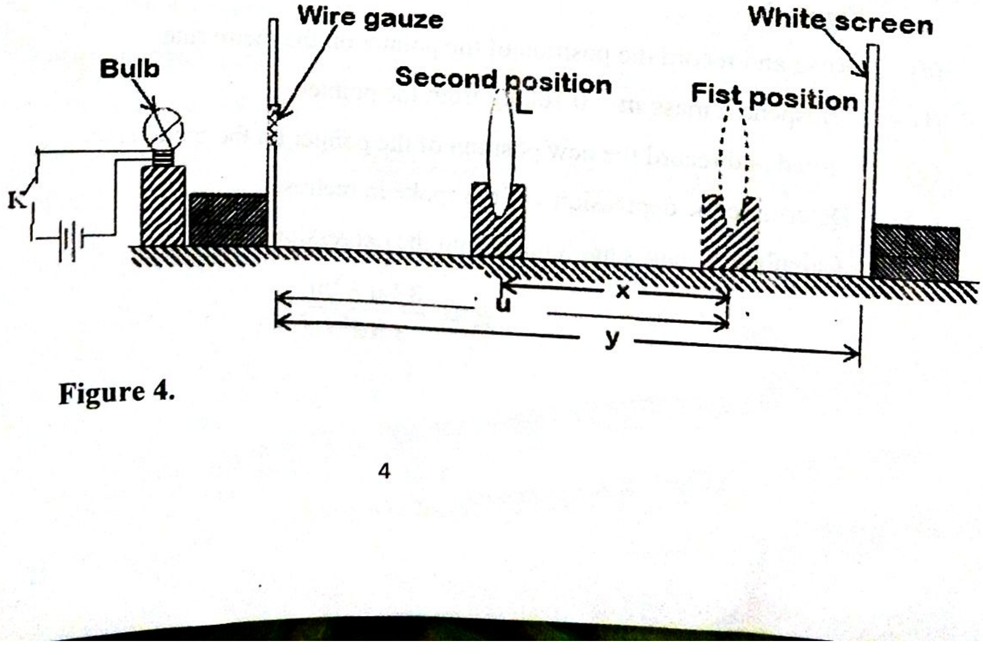


Figure 4.

(a) Connect the torch bulb in series with the dry cells and switch, K.

Se. up the arrangement shown in Figure 4.

(b) Adjust the position of the lens such that the distance $u = 40.0\ cm$.

(c) Adjust the position of the screen to until a clear sharp image of the wire gauze is obtained on the screen.

(d) Measure and record the distance, y, between the two screens.

(e) Without changing the position of the screens, displace the lens so that another clear image of the wire gauze is formed on screen.

(f) Measure and record the distance, x, between the two positions of the lens.

(g) Repeat procedures (c) to (g) for values of u = 50.0, 60.0, 65.0, 70.0 and 80.0 cm.

(h) Tabulate your results in a suitable table including values of x^2 and $\frac{x^2}{y}$.

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

(j) Read and record the intercepts, C_1 on the vertical axis and, C_2 on the horizontal axis.

(k) Calculate the focal length, f_2, from the expression, $f_2 = \frac{1}{8}(C_2 - C_1)$.

(l) State how best you would use your experimental results obtain the value of the focal length, f of the lens after carrying out the two methods.

(m) Why is it hard to get the focal length of a concave lens using the above method II?

3. ***In this experiment, you will determine***

(i) the internal resistance of a dry cell

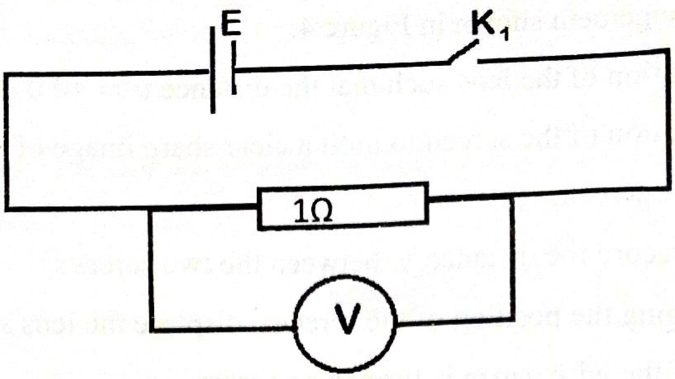
(ii) the resistance the electric bulb provided.

Part I

(a) Connect a voltmeter across the terminal of a dry cell labelled E.

(b) Read and record the voltmeter reading V_0.

(c) Connect the circuit as shown in figure 5 (a).



(d) Close the switch K_1.

(e) Read and record the voltmeter reading V_1.

(f) Calculate r_1 from $r_1 = \frac{(V_0 - V_1)}{V_1}$.

(g) Open the switch K.

(h) Replace the 1Ω resistor with a 5Ω resistor.

(i) Close the switch K

(j) Read and record the voltmeter reading V_2.

(k) Calculate r_2 from $r_2 = \frac{5\,(V_0 - V_2)}{V_2}$.

(l) Calculate r from, $r = \frac{(r_1 + r_2)}{2}$.

Part II

(a) Disconnect the circuit in Part I and connect a circuit as shown in figure 6 above with a torch bulb and wire W in parallel on one side of the metre bridge.

(b) Starting with $x = 0.300$m close the switches K.

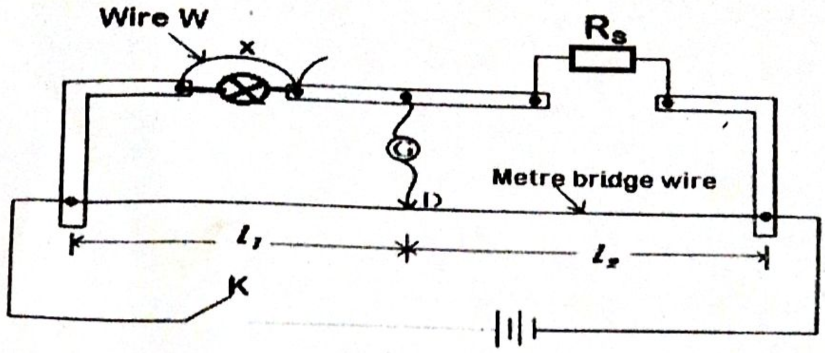


Figure 6

(c) Move the sliding contact J along the meter bridge slide wire AB and locate a point for which the galvanometer shows no deflection.

(d) Read and record the balance lengths l_1 and l_2.

(e) Open the switch K.

(f) Repeat procedures (b) to (e) for values of $x = 0.400,\ 0.500,\ 0.600,$ $0.700,$ and 0.800 m.

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

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

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

(j) Calculate the resistance r_2, from $r_2 = \frac{R_S}{S}$.

(k) Calculate the resistivity of the ρ, of the wire from $\rho = \frac{\pi d^2 r_{2,}}{S}$.

(l) Read and record the intercept, C on the $\frac{l_1}{l_2}$ – axis.

(m) Calculate the resistance r_b, of the bulb from $C = \frac{R_S}{r_b}$.

(n) State any ***two*** possible sources of errors in this experiment.

(o) State any ***two*** precautions you took in the experiment.

THE END