P510/3
PHYSICS
(PRACTICAL)
Paper 3
August 2016
$3^1/_4$ 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 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

1. **In this experiment, you will determine the modulus of rigidity, n, of the wire of the spring provided.**

Part I

(a) Measure and record the diameter **D** of the spring in metres.

(b) Measure and record the radius, **r**, of the wire of the spring in metres.

(c) Press the coils tightly together. Measure and record the length, **L**, of the pressed coils in metres.

(d) Count and record the number of turns **N** of the coils of the spring.

(e) Clamp the spring provided and the half metre rule as shown in figure 1.

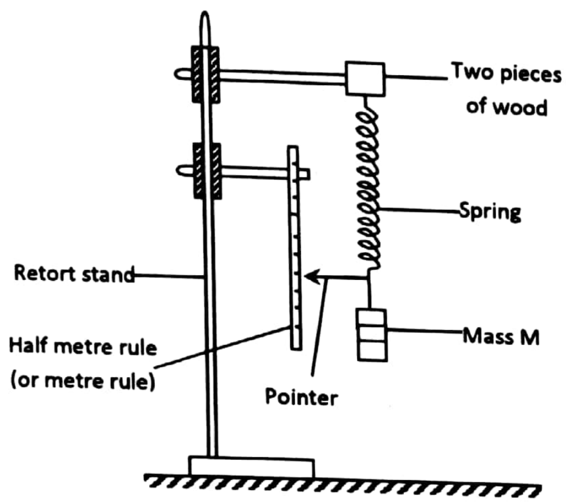

Fig. 1

(f) Read and record the initial position of the pointer on the half metre rule.

(g) Suspend a mass $M_1 = 0.300$ kg from the spring.

(h) Read and record the new position of the pointer.

(i) Find the extension, x_1, of the spring in metres.

(j) Repeat procedures (g) and (h) for $M_2 = 0.600$kg.

(k) Find the extension, x_2, of the spring in metres.

(*l*) Calculate the modulus of rigidity, n_1, of the spring from:

$$n_1 = \frac{15.7D^3N^5}{L^4}\left(\frac{M_1M_2}{M_1x_2 + M_2x_1}\right)$$

Part II

(a) Remove the half metre rule and suspend a mass, **m** = 0.250 kg from the spring as in Fig 1.

(b) Pull the mass vertically downwards through a small distance and release it to oscillate.

(c) Measure the time for 20 oscillations.

(d) Find the period, **T**.

(e) Repeat procedures (a) to (d) for values of **m** = 0.300, 0.350, 0.400, 0.450 and 0.500 kg.

(f) Tabulate your results including the values of $\mathbf{T^2}$.

(g) Plot a graph of $\mathbf{T^2}$ against **m**.

(h) Find the slope, λ, of the graph.

(i) Calculate the modulus of rigidity, $\mathbf{n_2}$, from

$$\mathbf{n_2} = \frac{2\pi^2 N D^3}{\lambda r^4}$$

(j) Find the modulus of rigidity, **n**, from:

$$\mathbf{n} = 0.50(\mathbf{n_1} + \mathbf{n_2})$$

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

Part I

(a) On the plane sheet of paper provided, draw a horizontal line UW about 10.0cm long.

(b) Place the prism on the white sheet of paper as indicated and trace its outline.

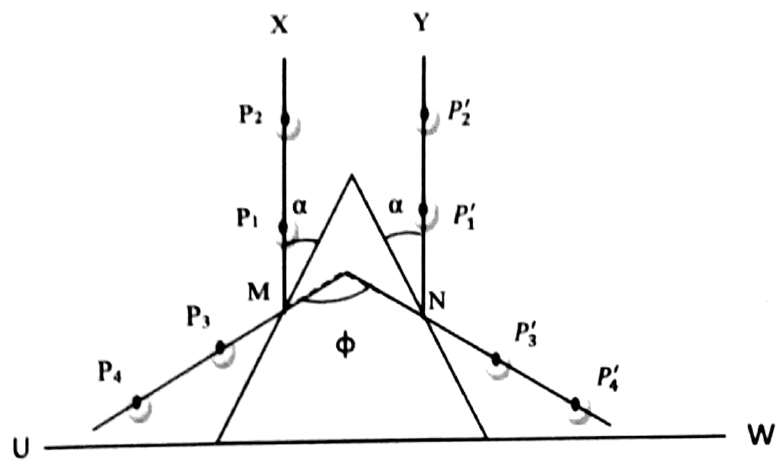

Fig. 2

(c) Remove the prism and mark points M and N mid-way the sides of the outline as shown in Fig. 2 above.

(d) Draw a line XM making an angle $\boldsymbol{\alpha} = 30^0$ with the side of the outline as shown in Fig. 2

(e) Fix pins P_1 and P_2 vertically along the line XM.

(f) Put back the prism on its outline. Looking into the prism stick pins P_3 and P_4 such that they appear to be in line with the images of P_1 and P_2.

(g) Remove the prism and the pins.

(h) Draw a line through P_3 and P_4 to meet the outline at M.

(i) Repeat procedures (d) to (g) for second face of the prism for line YN.

(j) Draw a line through P_3' and P_4' to meet the outline at N, produce it to meet the line through P_3, P_4 and M produced as shown in Fig.2.

(k) Measure and record angle $\boldsymbol{\phi}$.

Part II

(a) On the second plane sheet of paper provided, draw a line AB about 10.0cm long.

(b) Draw another line CQ making an angle, $\alpha = 25^0$ with AB at point D.

(c) Place the prism on the sheet of paper along AB and trace the outline as shown by the dotted lines.

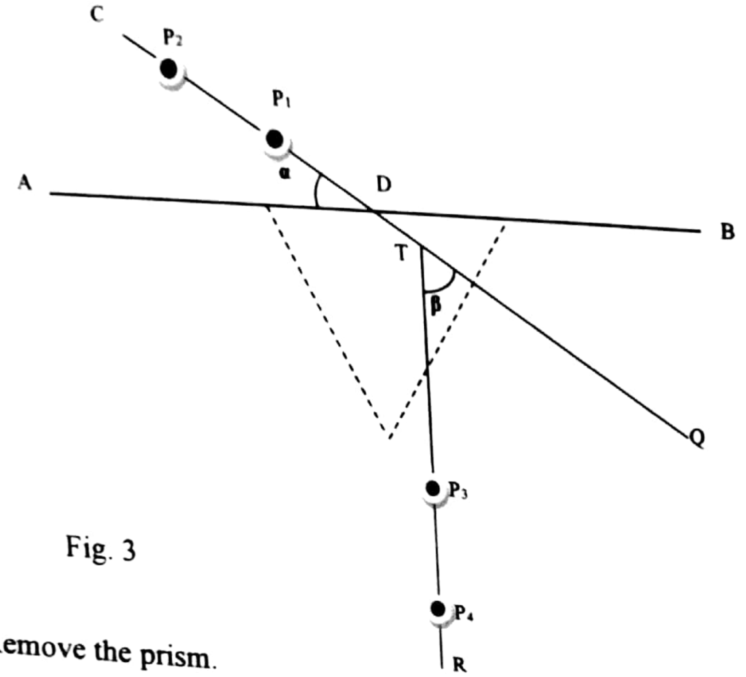

Fig. 3

(d) Remove the prism.

(d) Fix pins P_1 and P_2 vertically along the line CQ.

(e) Put back the prism on its outline. Looking through the prism stick pins P_3 and P_4 such that they appear to be in line with the images of P_1 and P_2.

(f) Remove the prism and the pins, and draw a line RT through P_4 and P_3 to meet CQ at T.

(g) Measure and record the angle β between RT and CQ.

(h) Repeat procedures (b) to (g) above for values of, $\alpha = 30^0, 35^0, 40^0, 45^0, 50^0, 55^0$ and 60^0.

(i) Plot a graph of β against α.

(j) Determine β_0, the minimum value of β.

(k) Calculate the refractive index n of the glass prism from

$$n = \frac{\sin\left(\frac{\Phi}{4} + \frac{\beta_0}{2}\right)}{\sin\frac{\Phi}{4}}$$

N.B: HAND IN THE TRACING PAPER USED IN THE EXPERIMENT TOGETHER WITH YOUR RESULTS.

3. **In this experiment you will determine the resistance per metre, δ, of a wire using two methods.**

PART I

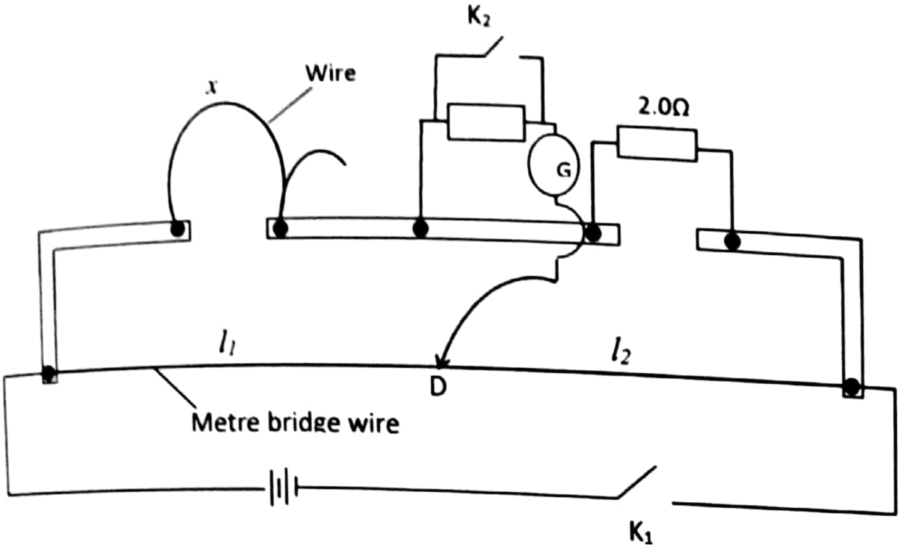

Fig. 4

a) Set up the circuit as shown in the figure above

b) Starting with $x_1 = 0.200$ m, close the switch K_1.

c) Move the sliding contact along the metre bridge wire to the point D where the galvanometer, G, shows no deflection. Close switch K_2 and find the balance point D accurately.

d) Measure and record the balance lengths l_1 and l_2.

e) Open switch, K_1 and K_2.

f) Repeat procedures (b) and (c) for $x_2 = 0.700$m

g) Measure and record the balance lengths l_3 and l_4 as in the order of l_1 and l_2.

h) Determine the resistance per metre of the wire, δ_1, from the expression;

$$\delta_1 = \left(\frac{l_1}{x_1 l_2} + \frac{l_3}{x_2 l_4}\right)$$

PART II

a) Set up the circuit as shown in figure 5 below.

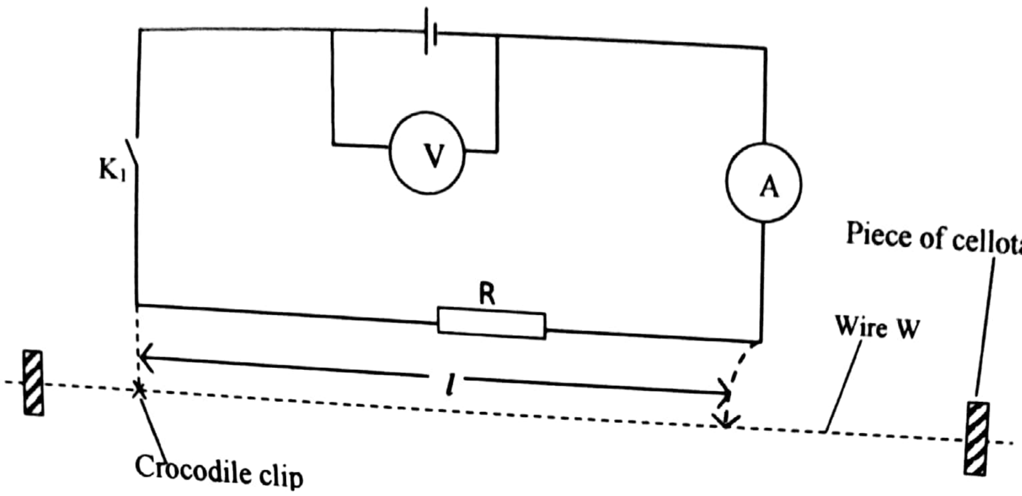

Fig. 6

b) With switch **K_1** open, read and record the voltmeter reading **V_0**.

c) Starting with $\boldsymbol{R} = 2.0\Omega$, Close **$K_1$** and record the ammeter reading **I**.

d) Open switch, **K_1**

e) Replace R with wire W provided as shown in Fig.6 using the dotted lines.

f) Close switch **K_1**.

g) Move the sliding contact along the wire until the ammeter reading is the same as in (c) above.

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

i) Open the switch, **K_1**.

j) Repeat procedures (c) to (i) for values of $\boldsymbol{R} = 3.0, 4.0, 5.0, 6.0$ and 7.0Ω.

k) Tabulate your results including values of $\frac{1}{I}$

l) Plot a graph of $\frac{1}{I}$ against $\boldsymbol{l}$.

m) Find the slope, s, of the graph.

n) Calculate the resistance per metre , δ_2, of the wire from the expression

$$s = \frac{\delta_2}{V_0}$$

o) Find the resistance per metre, δ, from:

$$\delta = \frac{1}{2}(\delta_1 + \delta_2)$$

END