P510/3
PHYSICS
PRACTICAL
Paper 3
3¼ hours

Uganda Advanced Certificate of Education

PHYSICS PRACTICAL

Paper 3

3 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

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

*Candidates are **not** allowed to start working with the apparatus for the first **15 minutes**.*

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.

Candidates are expected to record their observations as soon as they are made. Whenever possible, candidates should put their observations and calculations in a suitable table drawn in advance.

Details on the question paper should not be repeated in the answer and an account of the method of carrying out the experiment is not required.

Graph papers are provided.

Silent non-programmable calculators may be used.

1. In this experiment, you will determine the acceleration, g due to gravity.

PART I

a) Balance the metre rule on a knife edge and locate the point, **C** at which it balances.

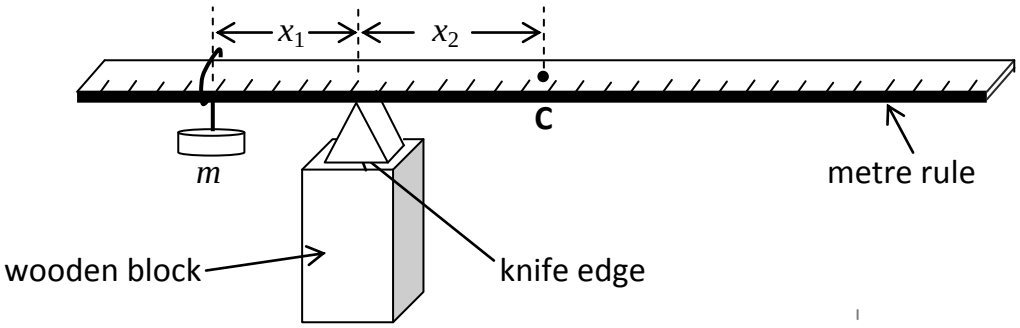

Fig. 1.1

b) Suspend a mass m = 0.100 kg from the 10.0 cm mark of the metre rule.

c) Balance the metre rule on a knife edge as shown in the figure 1.1.

d) Measure and record the distances x_1 and x_2.

e) Calculate the value of M from the expression:

$$M = \frac{mx_1}{x_2}$$

f) Measure and record the breadth, b and the length, l of the metre rule.

g) Calculate the value of k from the expression:

$$k = \frac{M}{12}(l^2 + b^2)$$

PART 2

a) Suspend the metre rule with its graduated face upwards from a clamped half-metre rule as shown in the figure 1.2.

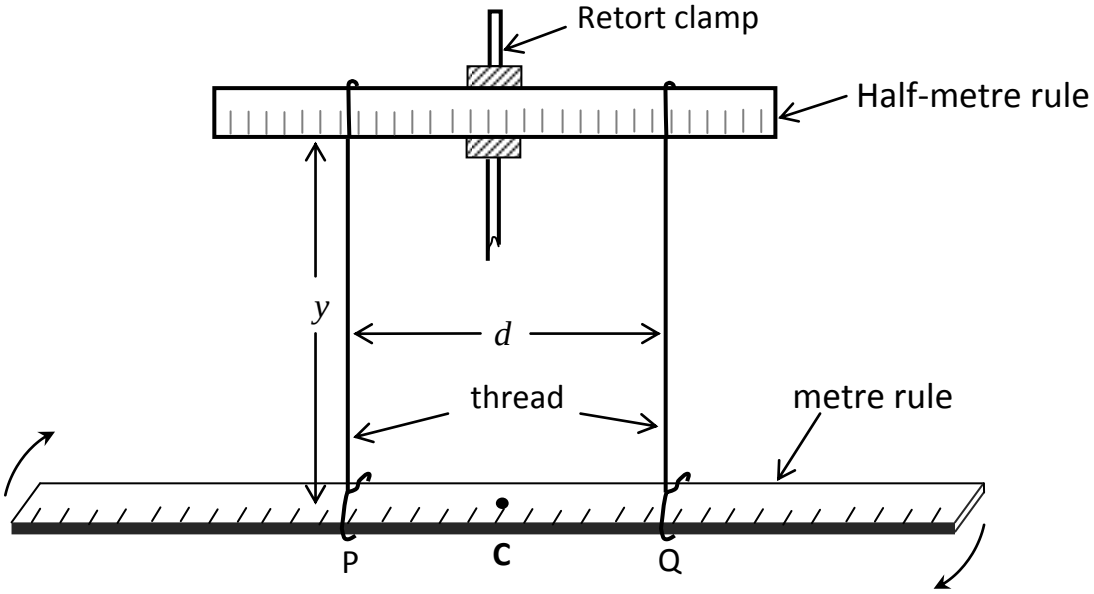

Fig. 1.2

b) Adjust the length, y of the threads to 0.500 m.

c) Start with a separation, d = 0.200 m of the threads such that the points P and Q are equidistant from point C of the metre rule.

d) Set the metre rule to oscillate in a horizontal plane by turning it through a small angle about point C and releasing it.

e) Measure and record the time, t for 20 complete oscillations.

f) Find the periodic time, T.

g) Repeat procedures (c) to (f) for values of d = 0.240, 0.280, 0.320, 0.360 and 0.400 m.

h) Tabulate your results including values of T^2 and $\frac{1}{d^2}$.

i) Plot a graph of T^2 against $\frac{1}{d^2}$.

j) Find the slope, S of the graph.

k) Calculate the value of g from the expression:

$$g = \frac{16\pi^2 yk}{MS}$$

2. In this experiment, you will determine the average breadth, *b* of the glass block provided.

a) Measure and record the breadth, b_1 of the glass block.

b) Fix a plain sheet of paper on the soft board.

c) Place the glass block on the paper with its broadest face uppermost and trace its outline ABCD.

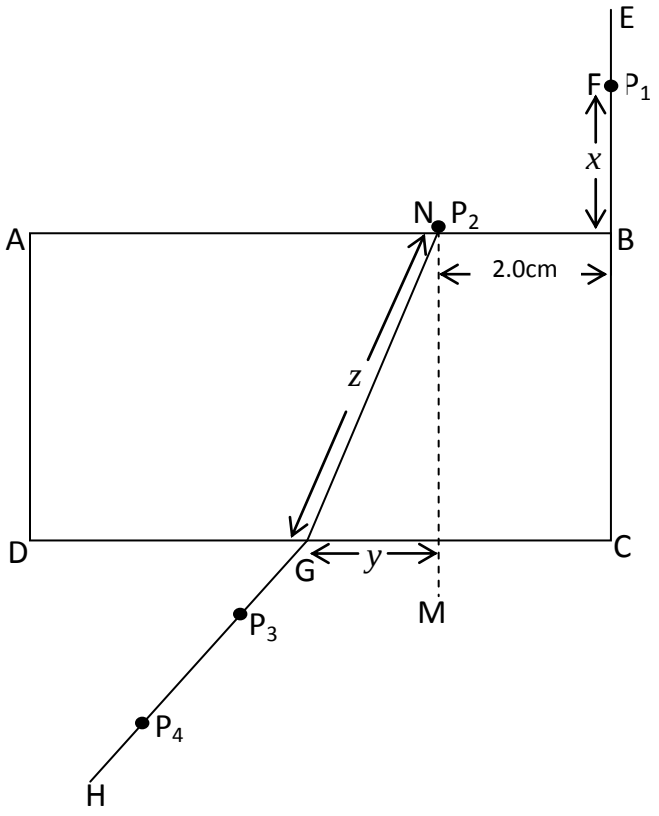

Fig. 2

d) Remove the glass block and draw a perpendicular line NM to side AB such that NB = 2.0 cm.

e) Extend BC to a point E such that BE = 6.0 cm.

f) Replace the glass block onto its outline and fix pin, P_1 vertically at point F, a distance of x = 0.8 cm from B as shown in the Figure 2.

g) Fix pin, P_2 vertically and close to side AB at point N.

h) While looking through the side DC of the glass block, fix pins P_3 and P_4 such that they appear to be in line with the images of P_1 and P_2.

i) Remove the glass block and the pins.

j) Draw a line HG through the positions of P_3 and P_4 to meet side DC at G.

k) Join G to N.

l) Measure and record the distances y and z.

m) Repeat procedures (f) to (*l*) for values of x =1.2, 1.6, 2.5, 3.5 and 5.5 cm.

n) Tabulate your results including values of $(z+y)$ and $\frac{1}{(z-y)}$.

o) Plot a graph of $(z+y)$ against $\frac{1}{(z-y)}$.

p) Find the slope, *S* of the graph.

q) Calculate the average breadth, b of the glass block from the expression:

$$b = \frac{b_1 + \sqrt{S}}{2}$$

HAND IN THE TRACING PAPER YOU HAVE USED.

3. In this experiment, you will determine the resistance per unit length, k of the bare wire labelled P provided.

METHOD I

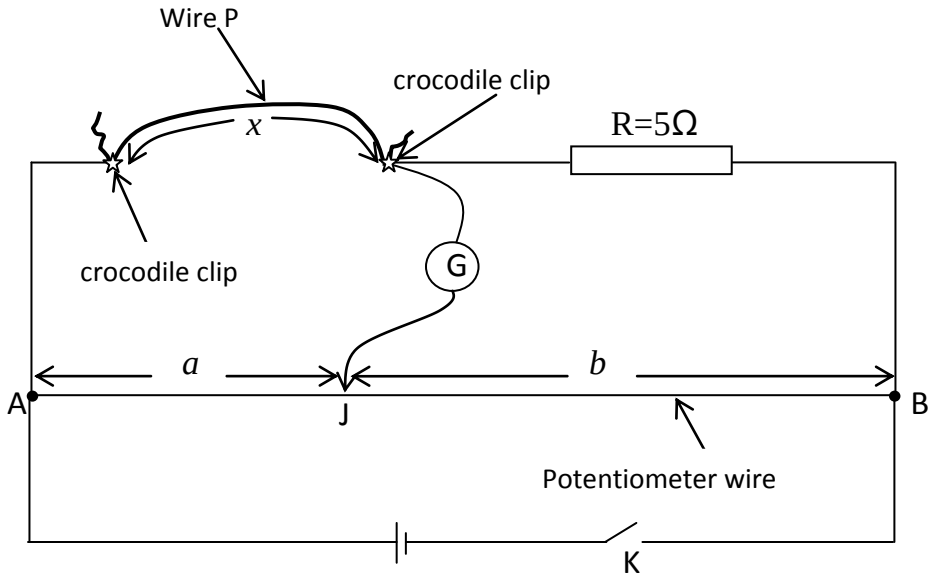

Fig. 3.1

a) Connect the circuit as shown in figure 3.1 with a length, x = 0.100 m of the wire P.

b) Close switch K.

c) Move the sliding contact along the potentiometer wire AB and locate a point J, for which the galvanometer shows no deflection.

d) Measure and record the balance lengths a and b, in metres.

e) Open switch K.

f) Repeat procedures (a) to (e) for values of x = 0.150, 0.200, 0.250. 0.300, and 0.400 m.

g) Tabulate your results including values of $\frac{1}{x}$ and $\frac{b}{a}$.

h) Plot a graph of $\frac{b}{a}$ against $\frac{1}{x}$.

i) Find the slope S, of the graph.

j) Calculate the value of k_1 from the expression:

$$k_1 = \frac{R}{S}$$

METHOD II

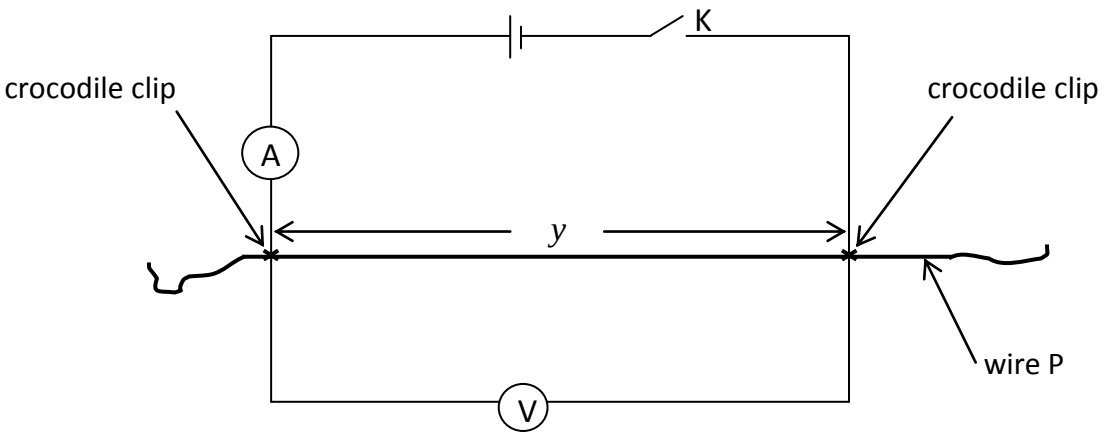

Fig. 3.2

a) Set up the circuit shown in figure 3.2.

b) Starting with a with length y_1 = 0.200 m, close switch K.

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

d) Open switch K.

e) Adjust the length of the wire P to y_2 = 0.400 m and close switch K.

f) Read and record the new ammeter reading, I_2 and the voltmeter reading, V_2.

g) Calculate the value of k_2 from the expression:

$$k_2 = \frac{V_2 - V_1}{I_2 y_2 - I_1 y_1}$$

h) Calculate the resistance per unit length k, of the wire P from the expression:

$$k = \tfrac{1}{2}(k_1 + k_2)$$

END.

LIST OF APPARATUS FOR UACE P510/3

QUESTION 1.

1 Retort stand and clamp
1 100 g mass
1 knife edge
1 Wooden block about 20 cm x 10 cm x 10 cm
1 Half metre rule
1 Metre rule
1 Piece of thread 20.0 cm long
2 Pieces of thread each 80.0 cm long
1 Stop clock or stop watch

QUESTION 2.

1 Soft board
1 Plain sheet of photocopy paper
1 Rectangular glass block
4 Optical pins
4 Drawing pins
1 Geometrical set ruler

QUESTION 3.

1 Ammeter (0 – 1A)
1 Voltmeter (0 – 3V or 0 – 5V)
1 Fresh dry cell (size D, 1.5V) in a holder
1 Switch labelled K
1 Centre-zero galvanometer
1 Jockey
1 Slide wire potentiometer
1 Half-metre rule
8 Pieces of connecting wire each about 50 cm long
2 Crocodile clips
1 5 ohm standard resistor labelled R=5Ω
1 Piece of bare **nichrome** wire (SWG 28) labelled P, of length 60.0 cm