P510/3
PHYSICS
PRACTICAL
Paper 3
1 August 2018
3 ¼ hours

ENTEBBE JOINT EXAMINATION BUREAU

Uganda Advanced Certificate of Education

PHYSICS PRACTICAL

Paper 3

3 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

Attempt **question one** *and* **one** *other question.*

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

Graph papers are provided.

Mathematical tables and non – programmable scientific 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 questions paper should not be repeated in the answer, nor is the theory of the experiment 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.

1. In these experiments you will determine the moment of inertia, ***I*** of a metre rule by two methods. *(34 marks)*

Method 1

(a) Measure and record mass *M (in kilogrammes)* of the metre rule labeled *X*.

(b) Clamp a half metre rule with its scale facing you.

(c) Tie two pieces of thread at points P and Q on the metre rule such that the distance $d = 0.100\ m$ and the threads are at equal distance from the 50.0 cm mark.

(d) Suspend the metre rule by using the two threads as shown in figure I. make sure the scale of metre rule faces upwards and the threads are parallel.

(e) Adjust the length, $l = 0.600\ m$

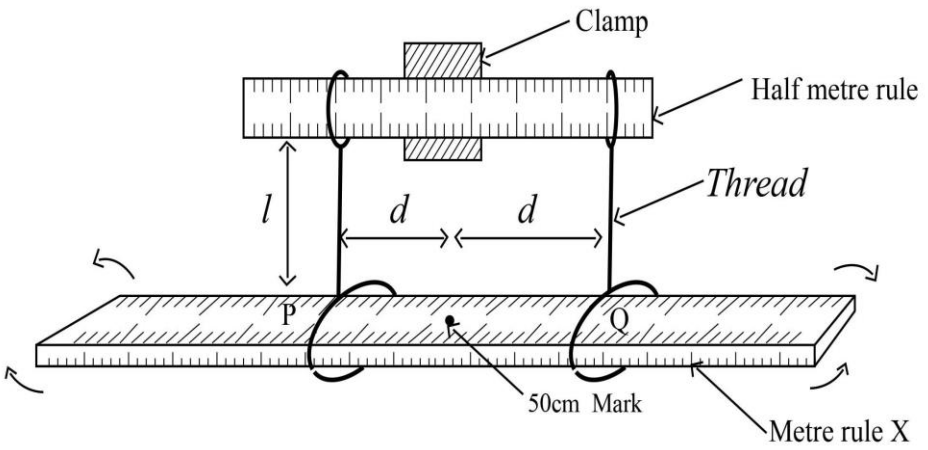

Fig I

(f) Turn the metre rule through a small angle about a vertical axis through the centre and releases it to oscillate horizontally as shown in figure I.

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

(h) Determine the period, T_0.

(i) Calculate the value, ***I*** from the expression:

$$I_1 = \frac{Mgd^2T_0}{4\pi^2 l} \qquad \text{where } g = 9.81\ ms^{-1} \text{ and } \pi = 3.14$$

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Method II

(a) Set up the apparatus as shown in figure II.

(b) Place two masses M each of mass 0.050 kg such that the distance, d_0 = 0.100 m from the 50.0 cm mark.

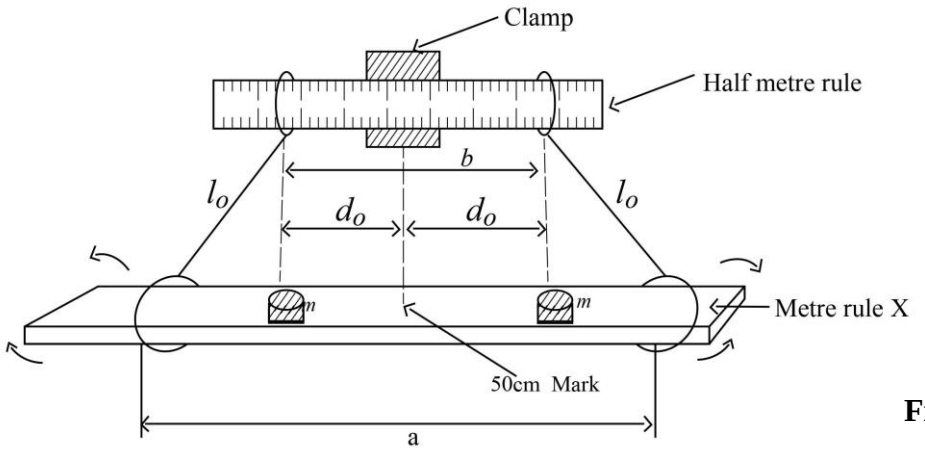


Fig II

(c) Adjust the distance, ***b*** to 0.200 m and the length, l_0 of the thread to 0.600 m.

(d) Adjust the separation, ***a*** of the threads to 0.900 m. Ensure that the threads are at equal distances from the 50 cm mark.

(e) Turn the metre rule through a small angle about a vertical axis through the centre and release it to oscillate horizontally.

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

(g) Determine the period ***T***.

(h) Repeat procedures from *(d)* to *(g)* for values of *a = 0.800, 0.700, 0.600, 0.500* and *0.400 m.*

(i) Tabulate your results including values of T^2 and $\frac{I}{a}$

(j) Plot a graph of T^2 against $\frac{I}{a}$

(k) Find the slope, ***S*** of your graph.

(l) Calculate the value of $\boldsymbol{I_2}$ from the expression:

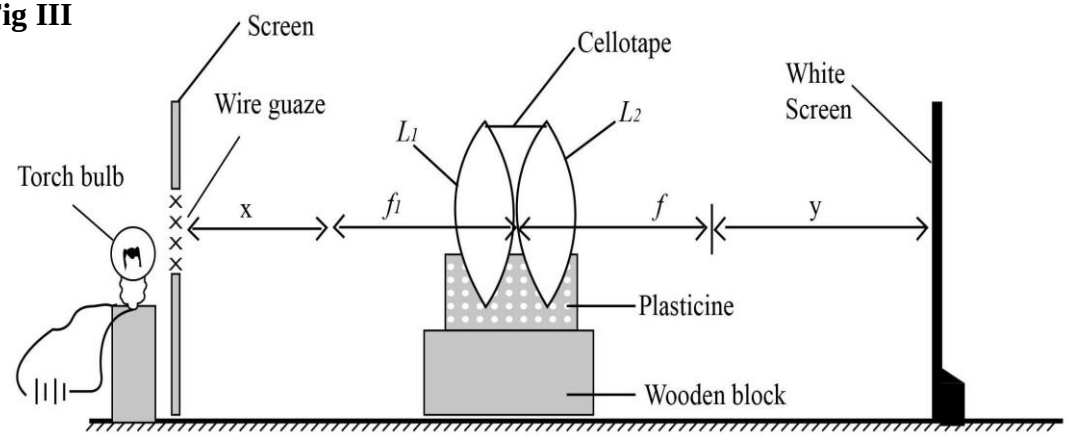
$$\boldsymbol{I}_2 = \frac{Mgbs}{4\pi^2 l_0}$$ where $g = 9.81\ ms^{-2}$, $\pi = 3.14$, $l_0 = 0.600\ m$

(m) Calculate the value, ***I*** from the expression:

$$\boldsymbol{I} = \frac{I_1 + I_2}{2}$$ **3**

2. In this experiment you will determine the focal length, f_2 of the convex lens, labeled L_2. *(33 marks)*

Fig III



(a) Place the lenses labeled ***L₁*** and ***L₂*** in contacts using cellotape to hold them at the edges.

(b) Fix the lenses on a wooden block using plasticine.

(c) Focus a distant object onto the white screen provided.

(d) Measure and record distance, ***f*** of the screen from the centre of the lenses.

(e) Place the torch bulb against a wire gauze at a distance *(f + x)* from the lenses, where *x = 10.0 cm* as shown in figure III.

(f) Adjust the position of the screen to obtain a clear image of the wire gauze.

(g) Measure and record distance ***z*** of the screen from the lenses.

(h) Find the value of $y = z - f$.

(i) Repeat procedures from (e) to (h) for *x = 15.0, 20.0, 25.0, 30.0* and *35.0 cm.*

(j) Record your results in a suitable table including values of $\frac{I}{x}$

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

(l) Determine the slope, ***S*** of the graph.

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(m) Find the focal length **F** of the two lenses from the expression:

$$\mathbf{F} = \sqrt{S}.$$

(n) Detact lens $\boldsymbol{L_2}$ from lens $\boldsymbol{L_1}$.

(o) Obtain a clear image of the wire gauze on the white screen when the wire gauze is at a distance of 20.0 cm and 40.0 cm from lens L_1.

(p) Measure and record the corresponding image distances V_1 and V_2 respectively.

(q) Calculate f_p and f_q from

$$f_p = \frac{20V_1}{20 + V_1} \quad \text{and } f_q = \frac{40V_2}{40 + V_2}$$

(r) Find the focal length, f_2 of the lens $\boldsymbol{L_2}$ from

$$f_1 = \frac{fp + fq}{2}$$

(s) Calculate the focal length, f_2 of lens $\boldsymbol{L_2}$ from the expression:

$$\frac{I}{F} = \frac{I}{f_I} + \frac{I}{f_2}$$

3. In this experiment you will determine the temperature of a lit torch bulb.

(a) Record the values of resistor labeled $\boldsymbol{R_0}$.

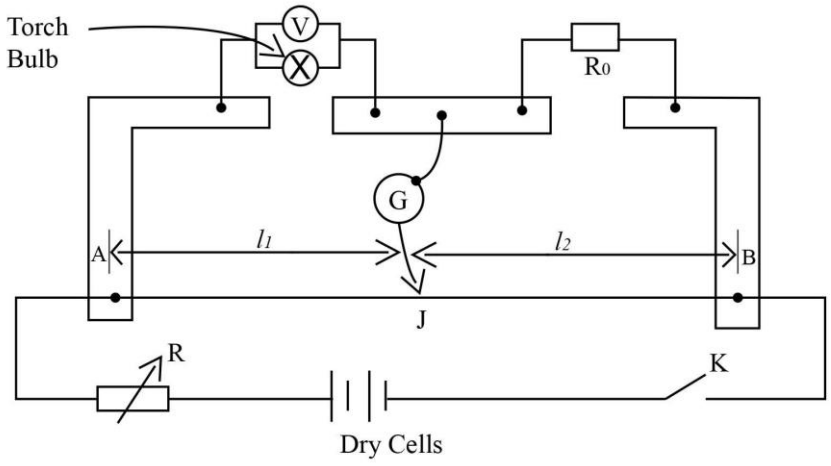

Fig IV

(b) Connect the circuit as shown in figure IV.

(c) Close switch ***K***.

(d) Adjust the rheostat, ***R*** until the voltmeter reads 0.10 V.

(e) Move the contract, ***J*** along the wire *AB* of the metre bridge to locate the balance point.

(f) Read and record the balance lengths, l_1 and l_2 in metres.

(g) Open switch ***K.***

(h) Estimate the resistance R_1 of the tungsten filament at room temperature from the expression:

$$R_1 = R_0 \left(\frac{l_1}{l_2} \right)$$

(i) Close switch ***K***.

(j) Adjust the rheostat so that the reading *V* of the voltmeter is 0.60 *V*.

(k) Move the sliding contact ***J*** along the wire *AB* to locate the balance point.

(l) Read and record the balance lengths l_1 and l_2 in metres.

(m) Open the switch.

(n) Repeat the procedures (j) to (m) for the values of *V = 0.70, 0.80,*
(o) *0.90, 1.00* and *1.10 V.*

(p) Tabulate your results including the values of:

$$R_1 = R_0 \left(\frac{l_1}{l_2} \right) \text{ and } \frac{V^2}{R}$$

(q) Plot a graph of $\frac{V^2}{R}$ against ***R*** and comment on your graph.

(r) Estimate the temperature of the tungsten filament of the bulb when the voltmeter reading V = 1.10 V from the expression:

$$\theta = \beta \left(\frac{R_\theta}{R_1} - 1 \right)$$

Where $\beta = 222.2^0$ C and R_θ is the resistance of the tungsten filament when V = 1.10 V.

END