P510/3
PHYSICS
Paper 3
Jul./Aug. 2024
3¼ hours

# WAKISO-KAMPALA TEACHERS' ASSOCIATION (WAKATA)

## WAKATA MOCK EXAMINATIONS 2024

## Uganda Advanced Certificate of Education

PHYSICS

**Paper 3**

3 hours 15 minutes

**INSTRUCTIONS TO CANDIDATES:**

*Attempt* **two (2)** *questions. Question* **one** *is compulsory.*

*Any additional question answered will not be marked.*

*Candidates will not be allowed to start working with the apparatus for the first quarter of an hour.*

*Marks are given mainly for a clear record of the observation and accuracy, and for the use made of them.*

*Non - programmable scientific calculators may be used. Graph paper is provided.*

1. In this experiment, you will determine acceleration due to gravity, $g$ by two methods. *(34 marks)*

## METHOD I

(a) Tie the pendulum bob at the end of the long piece of thread provided.

(b) Suspend the pendulum bob as shown in figure 1 by clamping the end of the thread using two small pieces of wooden blocks, such that the length, $l = 0.900m$.

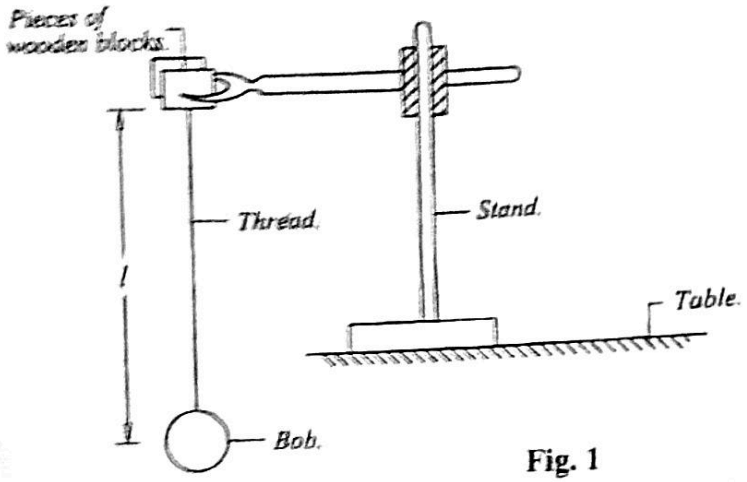


**Fig. 1**

(c) Displace the bob slightly and release it to oscillate.

(d) Measure and record the time, $t$ for 20 oscillations.

(e) Calculate period, T.

(f) Find the acceleration, $g$ due to gravity from, $g = \dfrac{4\pi^2 l}{T}$

(g) Dismantle the apparatus

## METHOD II

(a) Measure the length, $l$, of the metal rod provided.

(b) Bend the rod at its mid–point to form a $V$ – shape with $\theta = 120^0$ as shown in figure 2.

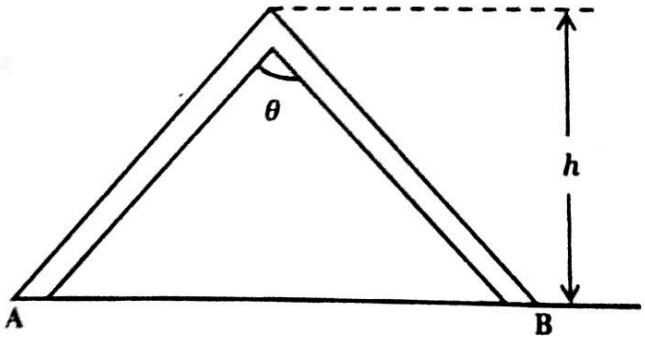


**Fig. 2**

(c) Measure and record the distance, $h$, with the rod resting on a flat surface and the ends $A$ and $B$ touching straight edge.

(d) Place the rod on a knife edge and set it swing in its own plane with small amplitude.

(e) Measure and record the time, $T$, for twenty oscillations and period, T for an oscillation.

(f) Calculate the frequency, $f = \frac{1}{T}$ of oscillation.

(g) Repeat the procedures (b) to (f) for $\theta = 110^0, 100^0, 90^0, 80^0$ and $70^0$.

(h) Tabulate your results including values of $f^2$ and $h$.

(i) Plot a graph of $f^2$ against $h$.

(j) Find the slope, $S$, of your graph.

(k) Calculate the acceleration due gravity from $g = 2\pi^2 l^2 S$

**2.** In this experiment, you will determine the refractive index, $n$ of liquid L provided *(33 marks)*

**METHOD I**

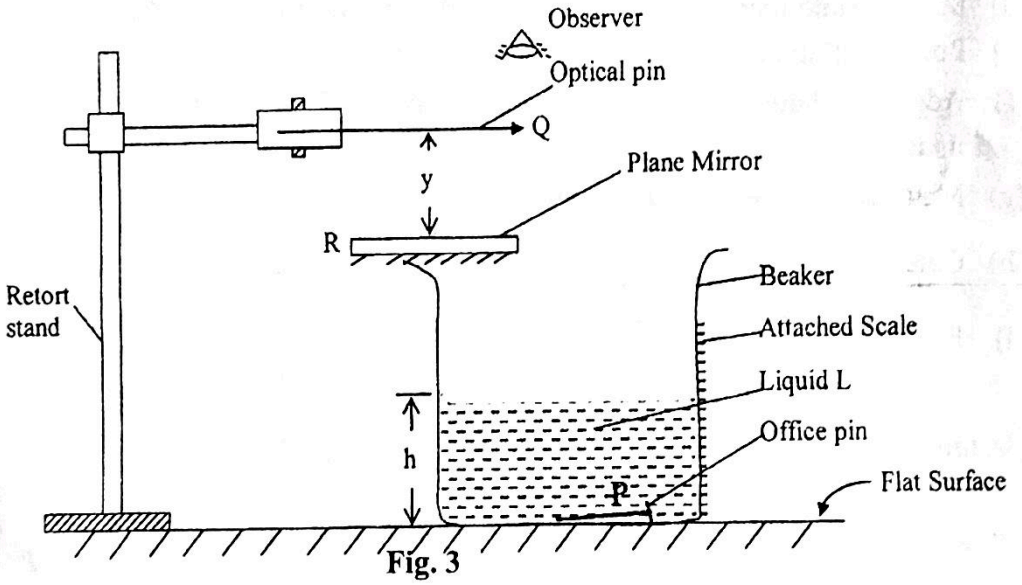


**Fig. 3**

(a) Place an office pin at the bottom of the beaker as shown in figure 3.

(b) Place a strip of a plane mirror across half the top of the beaker

(c) Gently pour liquid 'L' into the beaker to a depth $h = 2.0cm$

(d) Adjust the position of the pin Q until the image of Q coincides with the apparent position of , P, when viewed from a position vertically above mirror R

(e) Read and record the value, $y$, height of pin Q above plane mirror R

(f) Repeat procedures (c) to (e) for $h$ = 4.0, 6.0, 7.0, 8.0 and 9.0cm

(g) Tabulate your results

(h) Plot a graph of $h$ against $y$.

(i) Obtain the slope $n_1$ of the graph

## METHOD II

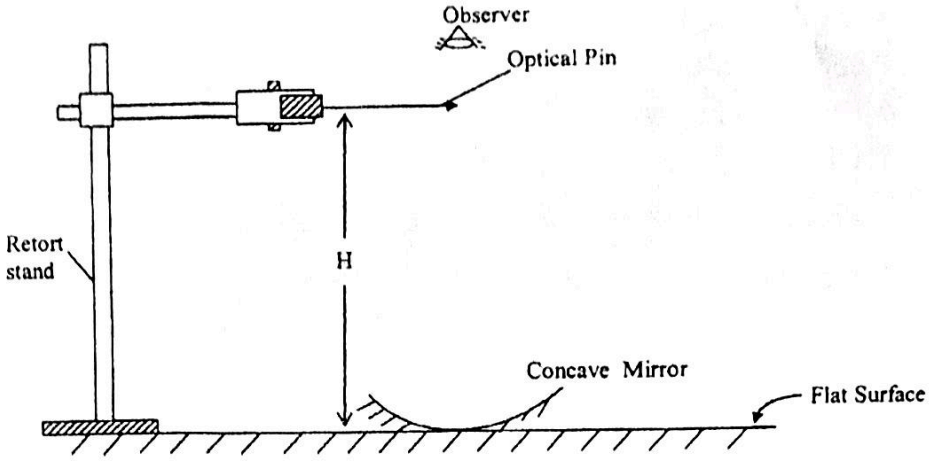


**Fig. 4**

(a) Place a concave mirror facing up wards on a flat surface as shown in figure **4**.

(b) Clamp the optical pin provided horizontally so that the pointed end lies along the vertical axis of concave mirror as shown in figure **4**.

(c) Adjust the height of the pin until the position is reached where it coincides with its image.

(d) Measure and record the distance, H of the pin from the pole of the mirror.

(e) Pour small quantity of liquid, L on the mirror.

(f) Adjust the height $h$, of the pin from the pole of the mirror until the pin coincides with its image

(g) Measure the height, $h$ of the pin from the pole of the mirror

(h) Calculate the value of, $n_2$ from: $n_2 = \frac{H}{h}$

(i) Find the value of $\left|\frac{n_2 - n_1}{n_1}\right| \times 100$

3. In this experiment, you will determine the resistivity, $\rho$ of the matrial of the wire labeled Z *(33 marks)*

(a) Measure and record the radius, $r$ in metres of the wire, $Z$

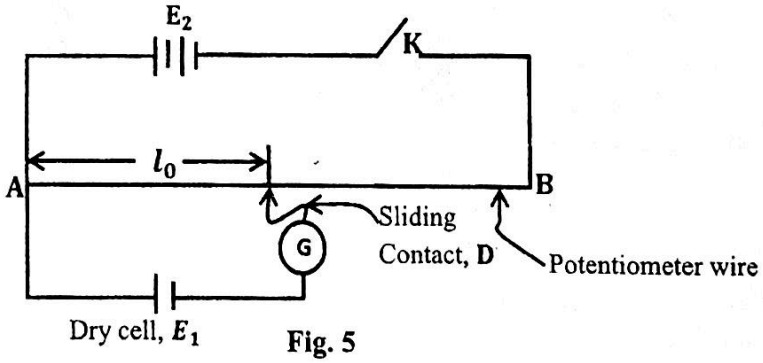


**Fig. 5**

(b) Close the circuit as shown in figure **5**

(c) Close switch, $K$

(d) Move the sliding contact, $D$ along the wire $AB$ until the galvanometer, $G$ shows no deflection.

(e) Measure and record the balance length $l_0$(in metres)

(f) Open switch, $K$ and disconnect the circuit in figure **5**.

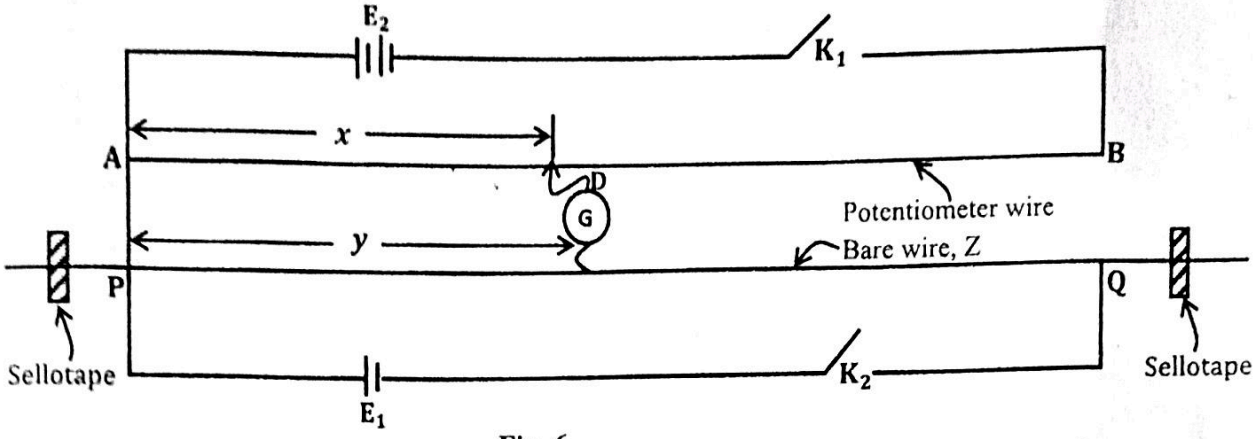


**Fig. 6**

(g) Connect the circuit as shown in figure **6**, such that $PQ = 1.00m$ and adjust the distance, $y = 0.200m$.

(h) Close switches, $K_1$ and $K_2$ and use the sliding contact, $D$ to find balance point.

(i) Measure and record the balance length, $x$.

(j) Open switches $K_1$ and $K_2$.

(k) Repeat the procedures in (g) to (i) $y = 0.300, 0.400, 0.500, 0.600$ and $0.700m$.

(l) Tabulate your results

(m) Disconnect the circuit in figure **6** and connect the circuit in figure **7**.

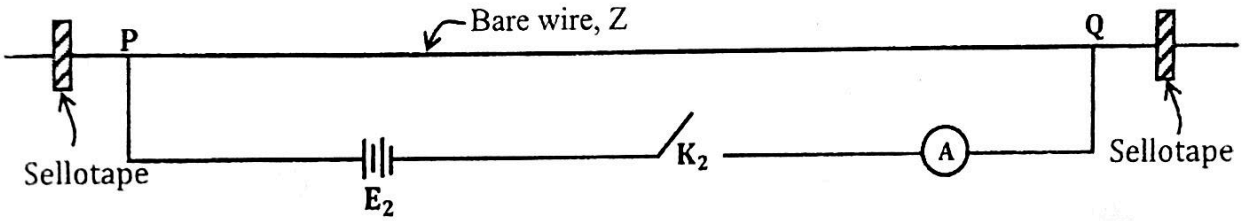


**Fig. 7**

(n) Close switch, $K_2$

(o) Read and record the current, $I_0$ in the circuit.

(p) Disconnect the circuit in figure **7**.

(q) Connect the voltmeter across cells $E_2$ and note the reading, $V_0$ on it.

(r) Plot a graph of $x$ against $y$.

(s) Find the slope, S of the graph.

(t) Calculate the value, $R$ from the expression: $\boldsymbol{R = \frac{SV_0}{l_0 I_0}}$

(u) Calculate the resistivity, $\rho$ of the material of the wire from the expression:

$$\boldsymbol{\rho = \pi r^2 R}$$



**END**