# MARANDA HIGH SCHOOL

## Kenya Certificate of Secondary Education

## PRE-MOCK EXAMINATIONS 2024

**232/3** **PHYSICS** **Paper 3**

**March/April 2024 – 2½ Hours**

Name: Marking Scheme ..... Adm No: .....

Class: .....Candidate's Signature: .....Date: 28/3/2024.

**INSTRUCTIONS TO CANDIDATES**

- *Write your name and index number in the spaces provided above.*
- *Sign and write the date of examination in the spaces provided*
- *Answer ALL the questions in the spaces provided in the question paper*
- *You are supposed to spend the first 15 minutes of the 2 ½ hours allowed for this paper reading the whole paper carefully before commencing your work.*
- *Marks are given for a clear record of the observations actually made.*
- *Non-programmable silent electronic calculators and KNEC Mathematical tables may be used except where stated otherwise.*

**FOR EXAMINERS USE ONLY**

**QUESTION 1**

| | d | e | f | g | TOTAL |
|---|---|---|---|---|---|
| Maximum Score | 7 | 5 | 6 | 2 | 20 |
| Candidate's Score | | | | | |

**QUESTION 2**

| | c | d | e | TOTAL |
|---|---|---|---|---|
| Maximum score | 7 | 5 | 8 | 20 |
| Candidate's score | | | | |

**TOTAL SCORE**

Duncan Ouya



**Question 1**

You are provided with the following apparatus:

- A bi convex lens
- A plane mirror
- Complete retort stand
- Some glycerine in a beaker
- Half meter rule
- Manilla card
- Two wooden blocks
- A dropper

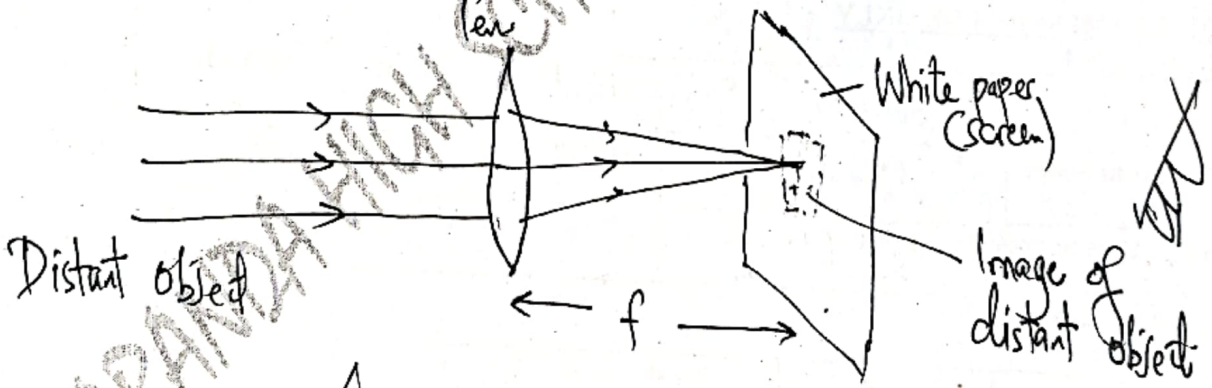
**Proceed as follows:**

a) Estimate the focal length, f of the lens provided.

f= 10.0 ± 2.0cm ..... cm ✓, 1dp a must (1 mark)

b) With aid of a diagram, describe the method you used to estimate f in (a). (2 marks)

Hold the lens and focus a distance object through the window/door while holding a white paper (screen) Measure the distance, f between the screen and the lens when a sharply focussed image is seen on the screen




✓, Statement description

✓, Diagram (workable)

Philemon Tambo



c) Clamp the wooden blocks so that they hold the manilla card horizontally, with the calibrated side upwards.

d) Place the plane mirror on a horizontal surface directly below the object manilla card and place the lens at the centre of the mirror as shown in **figure 1.**

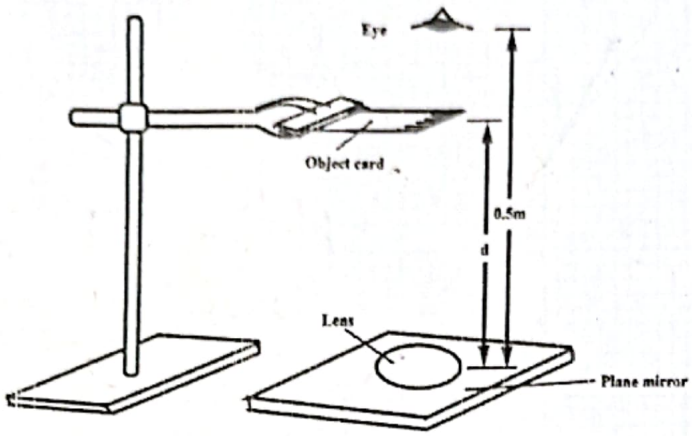



**Figure 1**

e) Measure a height *h*, where $h = 15\ cm$ measured from the surface of the mirror.

f) Keeping your eye about 0.50 m from the mirror, adjust the position of the mirror and lens so that you can see an image of the card in the central region of the lens.

g) By means of the millimeter scale on the top side of the object manilla card, determine the width of the image.

h) Repeat the experiment to obtain a series of corresponding values of h and b. Record the results in **table 1.**

**Note: invert the card for the images larger than the object so that the calibrated side faces the mirror**

**Determine the image width by relating to the object width.**

**Table 1** **(3 marks)**

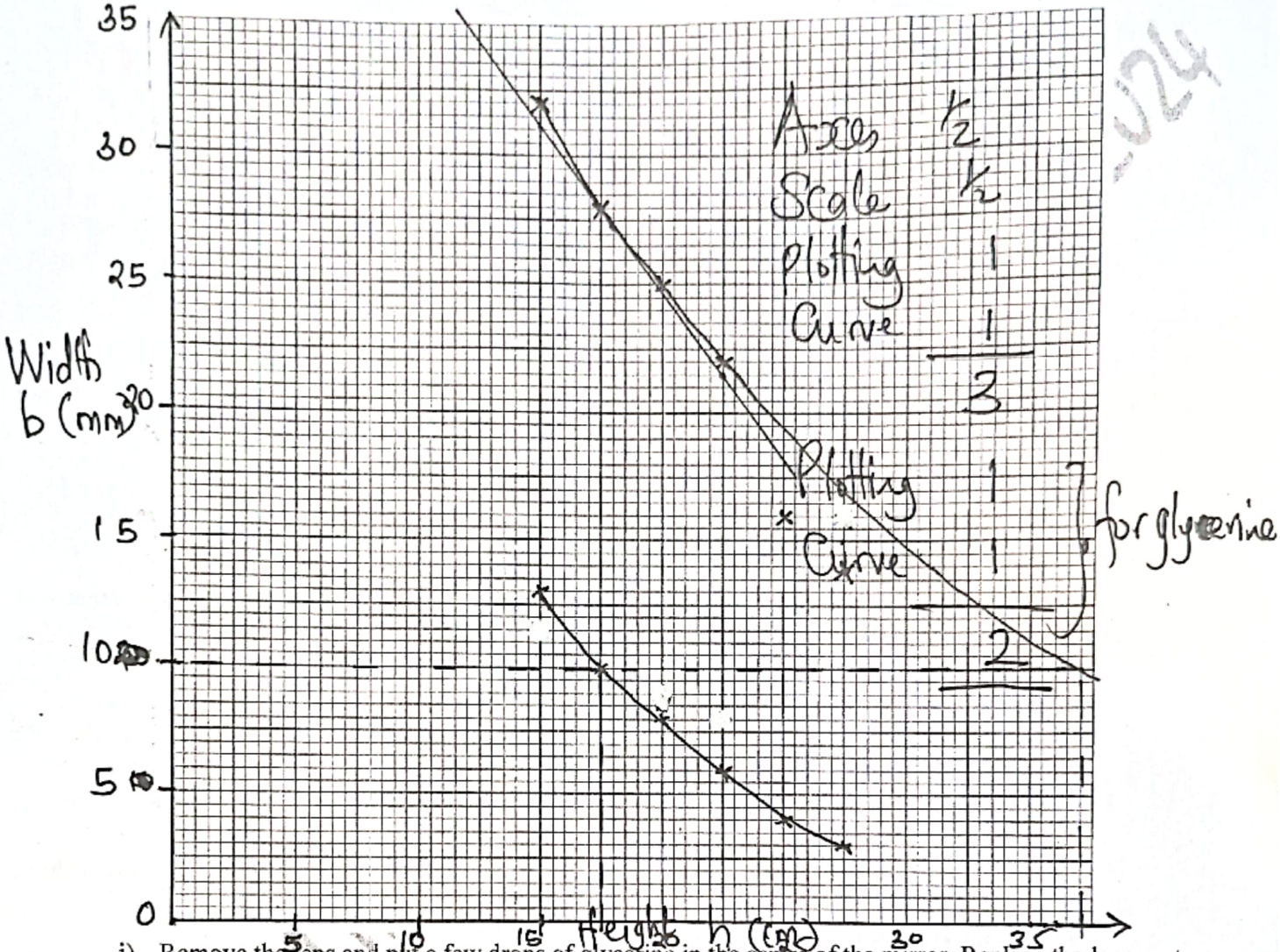
| Height *h* (cm) | 15.0 | 17.5 | 20.0 | 22.5 | 25.0 | 27.5 |
|---|---|---|---|---|---|---|
| Width *b* (mm) ± 3mm | 13 | 10. | 8 | 6 | 4 | 3 |

each ½ mark
Max 3

Linda Nyapola / Peter Andang'o



i) Plot a graph of width, b against height, h (3 marks)




j) Remove the lens and put a few drops of glycerine in the centre of the mirror. Replace the lens on top of the glycerine so that the glycerine fills the central region of the lens.

k) Repeat step (e) to obtain a series of corresponding values of *h* and new image width *b*. record the results in **table 2** **(3 marks)**

**Table 2**

| Height h (cm) | 15.0 | 17.5 | 20.0 | 22.5 | 25.0 | 27.5 |
|---|---|---|---|---|---|---|
| Width b (mm) ±3mm | 32 | 28 | 25 | 22 | 16 | 14 |

Each ½ mark
Max 3 marks

l) Using the same axes as in (g) plot a graph of width,*b* against height, *h* (2 marks)



08

Austine Oduor.



m) From the graphs, determine:

(i) $h_a$ the value of h when b = 10 mm (for air)

$h_a$ = 17·5 cm ✓1 with evidence from graph (1 mark)

(ii) $h_g$ the value of h when b = 10 mm (for glycerine)

$h_g$ = 37·0 cm ✓1 with evidence from graph (1 mark)

n) Determine the constant $k$ for glycerine from the expression $k = 2 - \frac{h_a}{h_g}$ (2 marks)

$K = 2 - \frac{17·5}{37·0}$ ✓1 correct substitution

1·527 ✓1 accuracy.

o) Find the gradient of the graph for glycerine when the height h = 18cm (2 marks)

(15,31)
(22·5,21·5)

gradient = $\frac{\Delta \text{ width } b, \text{ mm}}{\Delta \text{ height } h, \text{ cm}}$ ✓½ tangent drawn

$= \frac{(31 - 21·5)\text{ mm}}{(15 - 22·5)\text{ cm}}$ ✓½ read offs ✓½ read off.

$= \frac{9·5\text{ mm}}{-7·5\text{ cm}}$

$= -1·267$ mm/cm. ✓½ correct evaluation

Victor Odundo



**Question 2**

**PART A**

You are provided with the following apparatus:

- Metre rule
- Thread
- A complete retort stand
- Two masses, a 50g and 20g mass
- Water in a beaker
- Liquid X in a beaker

a) Suspend the metre rule so that it balances at its centre of gravity G. Read and record the value of G.

$G =$ 50.0 ± 1.0 (No mark) cm

b) Suspend the 50g mass at a distance $d = 10\ cm$, then suspend the 20g mass and adjust its position such that the metre rule is balanced as shown in the **figure 2**

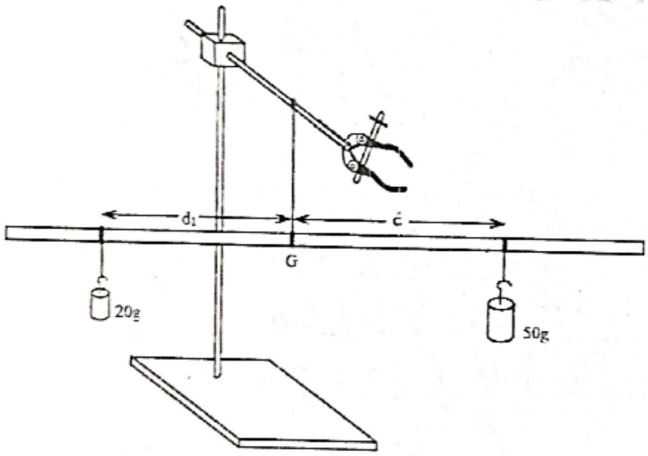



**Figure 2**

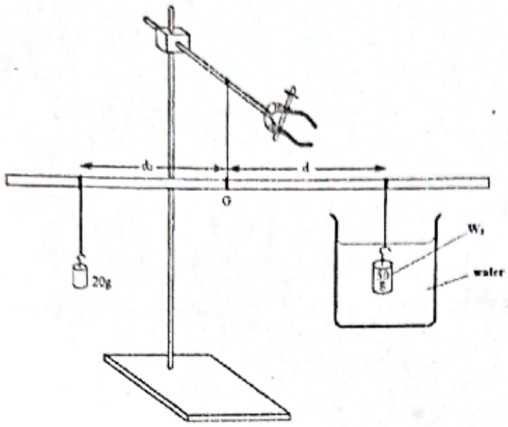
c) Record the distance distance $d_1$

$d_1 =$ 25.0 ± 1.0 cm ✓ 1 d.p a must (1 mark)

Victor Odundo



d) While maintaining the distance $d$, immerse the the 50g mass completely in water, as shown in the **figure 3.**




e) Adjust the position of the 20g mass to balance the metre rule again. Record the new distance $d_2$

$d_2$ = 22.0 cm ± 1.0 cm ✓1 1dp a must (1 mark)

f) Using the results obtained above, calculate the value of $W_1$, weight of the 50g mass in water. (2 marks)

$F_1 d_1 = F_2 d_2$

$\frac{20}{1000} \times 10 \times \frac{22}{100} = \frac{10}{100} \times W_1$ ✓1 Substitution

$W_1 = 0.44N$ ✓1 accuracy

g) Determine the upthrust $U_1$ on the 50g mass in water. (1 mark)

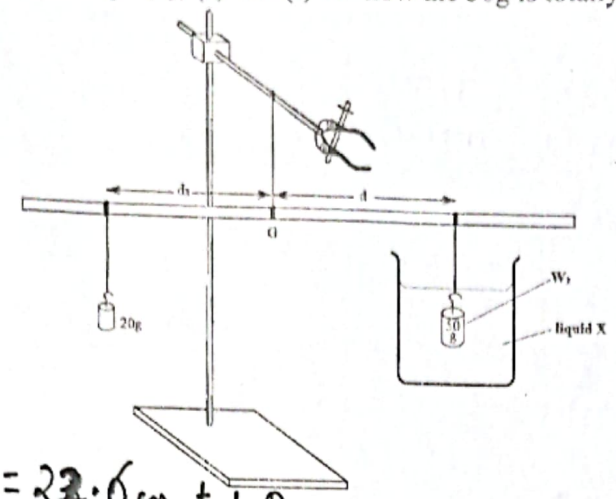
Upthrust $U_1 = 0.5N - 0.44N$ ✓½

$= 0.06N$ ✓½

Kennedy Otieno.



h) Repeat steps (d), (e) and (f) but now the 50g is totally immersed in liquid X as shown in the **figure 4**




$d_3 = 22.6\,cm \pm 1.0\,cm$

**Figure 4**

i) Using the results obtained above, calculate the value of $W_2$, weight of the 50g mass in liquid X.(1 mark)

$F_1 d_1 = F_2 d_2$

$\frac{20}{1000} \times 10 \times \frac{22.6}{100} = \frac{10}{100} \times W_2$ ½ Substitution

$W_2 = 0.452N$ ½ accuracy

j) Determine the upthrust $U_2$ on the 50g mass in liquid X. (1 mark)

Upthrust $U_2 = 0.5N - 0.452N$ ½

$0.048N$ ½

k) Given that $\rho_L = \frac{U_2}{U_1} \times \rho_w$ where $\rho_w = 1000 kgm^{-3}$ . Calculate $\rho_L$ (1 mark)

$\rho_L = \frac{0.048N}{0.06N} \times 1000 kg/m^3$ ½ substitution

$= 800 kg/m^3$. ½ accuracy

PART B

You are provided with the following:

- four 10 Ω resistors
- a resistance wire labelled Q mounted on a half metre rule
- a resistance wire AB mounted on a metre rule
- two dry cells and a cell holder
- a centre zero galvanometer G
- 8 connecting wires each with a crocodile clip at one end
- a jockey
- a micrometer screw gauge
- a switch

**Proceed as follows:**

a) Set up the circuit as in **figure 5** in which **R** is near A and Q is near B. (R is a 10 Ω resistor or an appropriate combination of 10-ohm resistors).

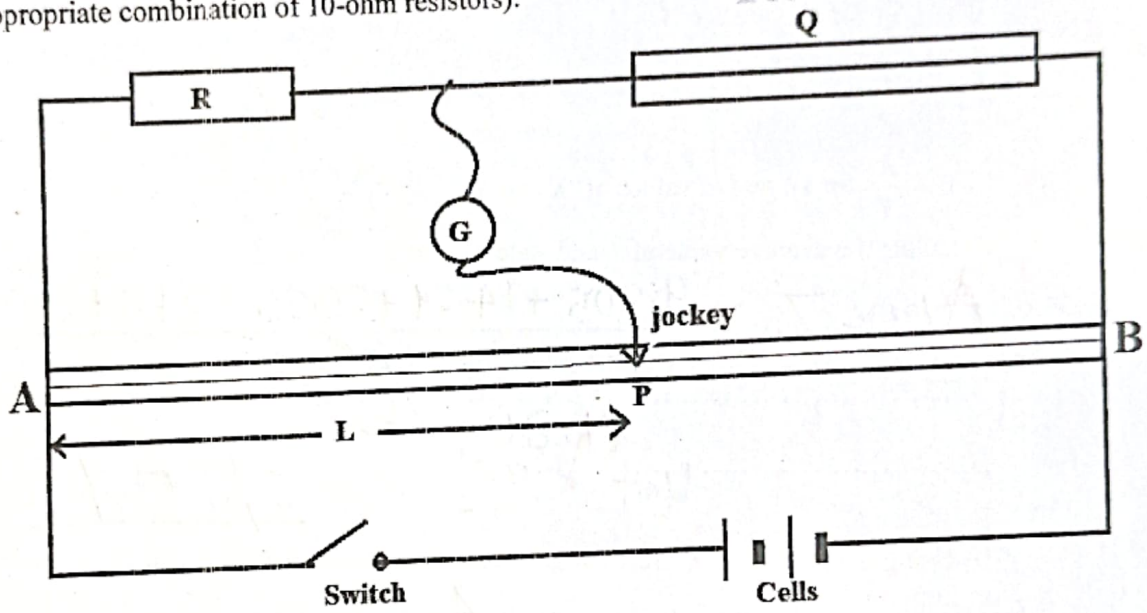



**Figure 5**

b) Starting with a single 10 Ω resistor as **R**, close the switch. Using the jockey tap wire AB briefly near end A and observe the deflection on the galvanometer. Now tap the wire near end B and again observe the deflection of the galvanometer. (*The two deflections should be in opposite directions*)

c) Still with the 10 Ω resistor as **R**, tap at various points along wire AB to obtain a point P at which the galvanometer shows zero deflection. Measure and record in **table 3** the length **L** between A and P.

Rev. Peter Okoth / Maurice Asoro



d) Repeat part (c) to obtain L for other values of R shown in table 3. (3 marks)

each ½ mark max 3. 3dp amust

| R (Ω) (cm) | 5 | 10 | 15 | 20 | 25 | 30 |
|---|---|---|---|---|---|---|
| L (m) ± 0.020m | 0.510 | 0.700 | 0.740 | 0.830 | 0.870 | 0.890 |
| $X = \frac{1}{L}(m^{-1})$ | 1.961 | 1.429 | 1.351 | 1.205 | 1.149 | 1.124 |
| $Y = \frac{1}{R}(\Omega^{-1})$ | 0.2 | 0.1 | 0.06667 | 0.05 | 0.04 | 0.03333 |
| $Z = \frac{X}{Y}$ | 9.805 | 14.29 | 20.26 | 24.1 | 28.73 | 33.72 |

(all 4sf or exact 1mk) (all 4sf or exact 1mk) (all 4sf or exact 1mk)

e) Determine:

(i) $\frac{1}{L}$ for all values of L (1 mark)

(ii) $\frac{1}{R}$ for all values of R (1 mark)

(iii) $\frac{X}{Y}$ for all sets of values of X and Y (1 mark)

f) Calculate the average value of Z and state its unit (2 marks)

Average Z = $\frac{9.805 + 14.29 + 20.26 + 24.1 + 28.73 + 33.72}{6}$ ✓½

= 21.80 ✓k

Unit = $\frac{m^{-1}}{\Omega^{-1}}$ = Ω/m Ohm/meter ✓1

g) (i) Using the micrometer screw gauge provided, measure and record the diameter **D** of wire Q in millimetres.

D = 0.32 ± 0.02 mm. ✓1 2dp a must (1 mark)

(ii) Record D in metres.

D = $\frac{0.32}{1000}$ = 0.00032m. ✓1 5dp a must (1 mark)

h) Determine the value of constant **K** given that: $4K = \pi D^2 Z$ (2 marks)

$4 \times K = \frac{22}{7} \times (0.00032)^2 m^2 \times 21.80 \Omega/m$ ✓1 correct substitution

$K = 1.754 \times 10^{-6} \Omega m$ ✓1 accuracy with units correct.