NAME: MARKING GUIDE ..... CLASS: ..... ADM. NO. .....

INDEX NO..... SIGNATURE: ..... DATE: .....

232/3
PHYSICS
PAPER 3
(PRACTICAL)
SEPTEMBER 2022
TIME: 2 ½ hours

MANGU HIGH SCHOOL
MOCK EXAM
PAPER 3

INSTRUCTIONS TO CANDIDATES

(a) Write your Name, Index Number and Admission number in the spaces provided above.
(b) Sign and write the date of Examination in the spaces provided above.
(c) Answer all questions in the spaces provided.
*(d) You are supposed to spend the first **15 minutes** of the 2½ hours allowed for this paper reading the whole paper carefully before commencing your work.*
(e) Marks will be given for clear records of observations actually made, their suitability, accuracy and the use made of them.
(f) Candidates are advised to record their observations as soon as they are made.
*(g) **All working must be clearly shown** where necessary.*
(h) Mathematical tables and silent electronic calculators may be used.
(i) This paper consists of 8 printed pages. Candidates are advised to check that all pages are printed as indicated and no questions are missing.

FOR EXAMINER'S USE ONLY

Question(s)	Maximum Score	Candidate's Score
1	20 marks	
2	20 marks	
TOTAL	40 marks	

QUESTION 1 (20 MARKS)

1. You are provided with the following;
   - A galvanometer
   - A dry cell and a cell holder
   - A switch
   - A wire labelled Y mounted on a piece of wood.
   - Eight connecting wires each with a crocodile clip at one end.
   - A resistance wire labelled AB mounted on a millimeter scale.
   - Six 10 Ohm carbon resistors
   - A jockey or crocodile clip
   - Micrometer screw gauge (to be shared)

Proceed as follows:

(a) Set up the circuit as shown in **figure 1** below, with X being one of the 10 ohms carbon resistors.

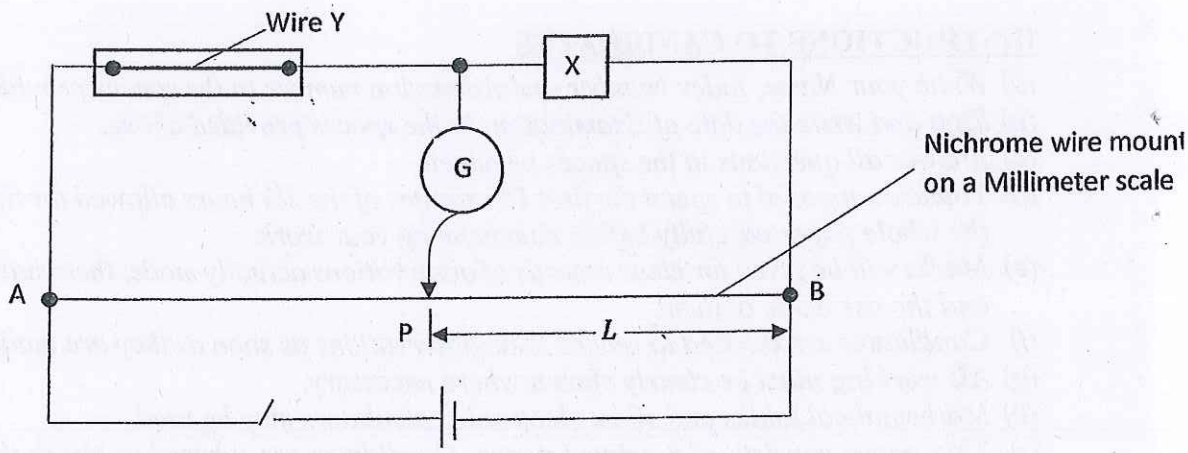


Figure 1

(b) Close the switch. Tap the jockey at various points on the wire AB and locate point P at which the galvanometer shows zero deflection, measure and record in table below the length, l where l= PB.

(c) Repeat the procedure in (b) using X as two 10Ω resistors, three resistors, four resistors, five resistors and six resistors. **X is the effective resistance for the parallel combination** **i.e.** $\mathbf{X = \frac{10}{n}}$ where **n** is the number of resistors in parallel.

(d) Record your readings in **table 1** below. **(6 marks)**

Table 1

Number of 10Ω Carbon resistor	One	Two	Three	Four	Five	Six
X (Ω)	10	5	3.3333 (4 s.f)	2.5	2	1.666 (4 s.f) ✓
L (cm) ±0.5	59.0	40.7	31.5	25.4	21.4	18.8
$\frac{1}{X}$ (Ω^{-1})	0.1	0.2	0.3	0.4	0.5	0.6
$\frac{1}{L}$ (cm^{-1})	0.01695	0.02457	0.03174	0.03937	0.04673	0.05319

½ mark max ✓ ✓

(e) Plot a graph of $\frac{1}{L}$ (y-axis) against $\frac{1}{X}$ **(5 marks)**

Follow SS work If line is curve or negative gradient don't award for line.

(f) Determine the slope m of the graph. **(2 marks)**

$m = \frac{\Delta 1/L}{\Delta 1/X} = \frac{0.039 - 0.0245}{0.4 - 0.2}$ ✓ ✓

$= \frac{0.0145}{0.2} = 0.0725\ \Omega/cm$ No units ½ mk

If line is wrong in e) deny gradient mark.

(g) Given that $\frac{1}{L} = \frac{R}{KX} + \frac{1}{K}$ where K = 100cm. Use the graph to determine R. **(2 marks)**

Follow SS work

gradient = R/K ✓

$0.0725 = R/100$ ✓ $= 7.25\ \Omega$ ✓ No units ½ mk

(h) Measure the diameter d and the length l of wire Y. **(2 marks)**

l = 0.300 ± 0.01 m ✓

d = 2.3×10^{-4} m ✓

$2.1 - 2.6 \times 10^{-4}$

(i) Determine the cross-sectional area A of the wire Y. **(1 mark)**

A=.....m^2

$A = \pi r^2$

$= \frac{22}{7} \times \left(\frac{2.3 \times 10^{-4}}{2}\right)^2$

$= 4.156 \times 10^{-8}\ m^2$

(j) Determine the resistivity ρ of the wire Y given that its Resistance, $\mathbf{R = \rho \frac{l}{A}}$. **(2 marks)**

$R = \frac{\rho L}{A}$ $\rho = 9.975 \times 10^{-7}\ \Omega m$

$7.25 = \frac{\rho \times 0.3}{4.156 \times 10^{-8}}$ No units

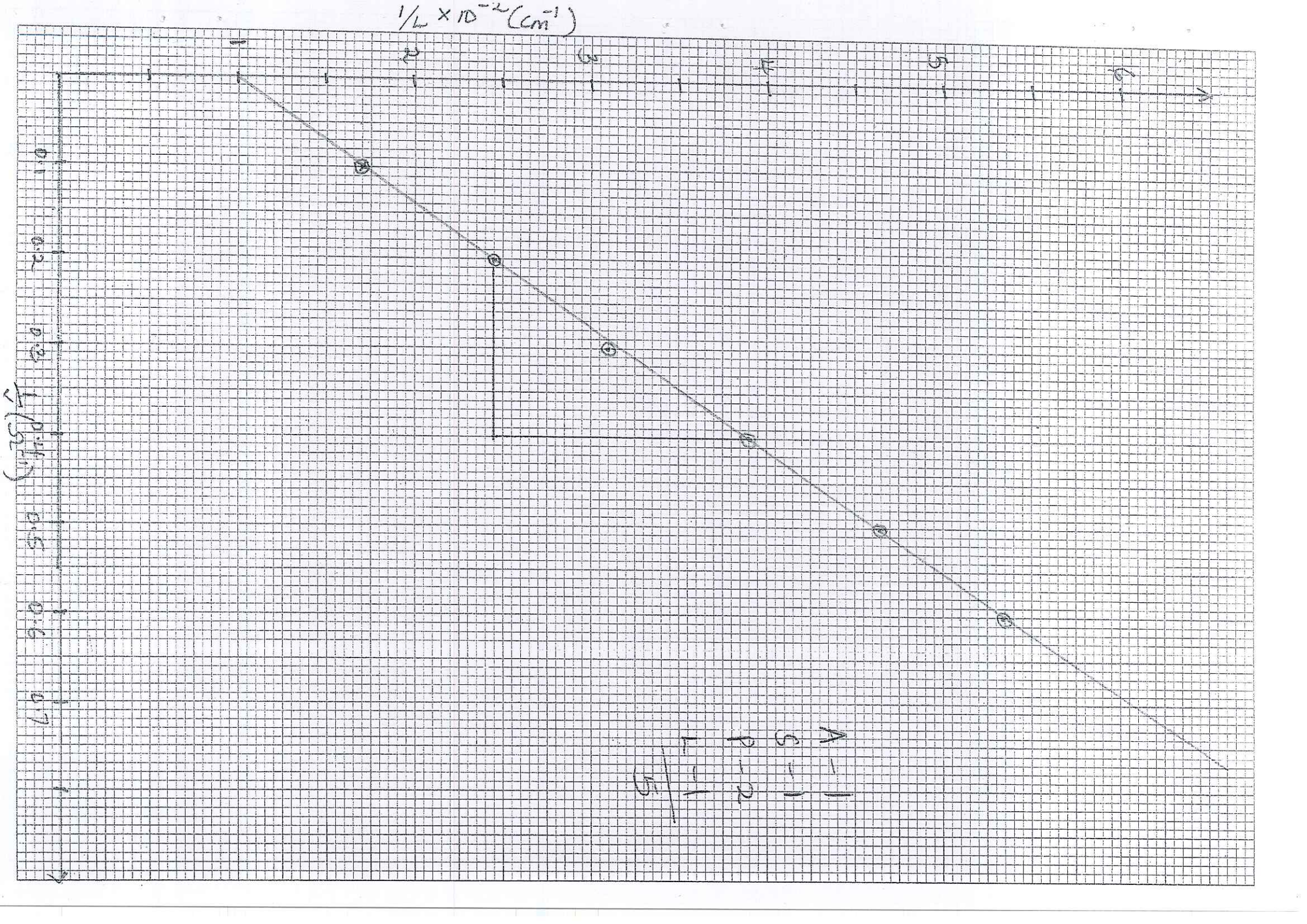
½mk

QUESTION 2 (20 MARKS)

PART A

You are provided with the following:

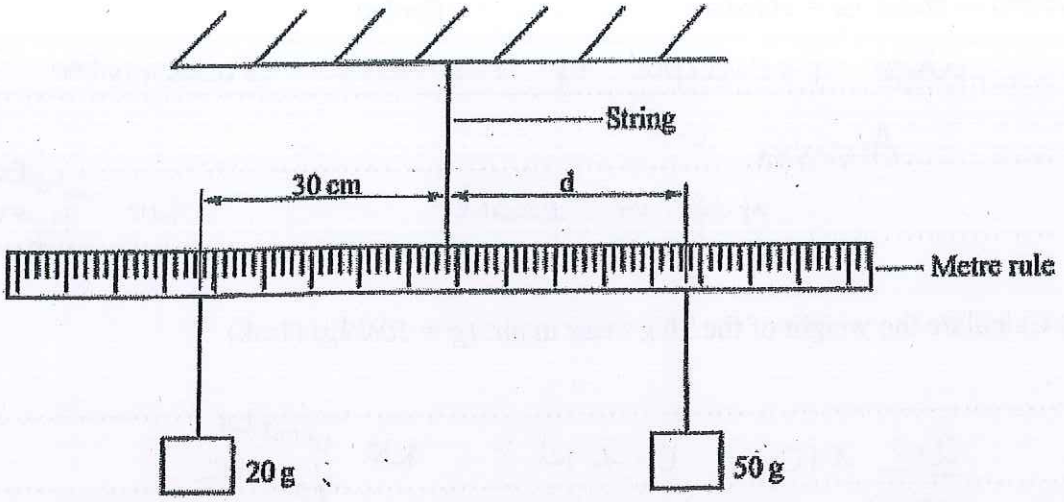
- **A metre rule**
- **A stand, boss and clamp**
- **A piece of string**
- **A 20 g mass**
- **A 50 g mass**
- **A measuring cylinder containing water**
- **A concave mirror**
- **A screen**
- **A candle**
- **Pieces of sewing threads**
- **A mirror holder (Lens holder)**


1/λ × 10⁻² (cm⁻¹)
1
2
3
4
5
6
1.0
2.0
3.0
4.0
5.0
6.0
7.0
1/n²
1 − 1/2²
1 − 1/3²
1 − 1/4²
1 − 1/5²
1 − 1/6²

(a) Using a string, suspend the metre rule on the stand so that it balances horizontally at its center of gravity. Record the centimetre mark at which the metre rule balances.

Centimetre mark = 50.0 ✓ cm 47-53.0 cm 1dp (1 mark)

(b) With the metre rule balanced at its centre of gravity, suspend a 20 g mass at a distance of 30 cm from the centre of gravity. Suspend the 50 g mass on the other side of the centre of gravity and adjust its position until the rule is balanced. See figure 3.



Record the distance d of the 50 g mass from the centre of gravity.

d = 15.0 cm ± 1 cm ½ 1d.p

d = 0.150 m ½ (1mk) 3dp

c) (i) Record the volume of the water in the measuring cylinder provided. 1mk

V = 17 cm^3 ✓ Accept ml

15 - 20 cm^3

(ii) Immerse the 20g mass fully into the water and adjust the position of the 50 g mass so that the rule balances horizontally. Record the volume V_1 of the water plus 20 g mass and the distance d_1 of the 50 g mass from the centre of gravity.

V_1 = 20 cm^3 (1mk) 17.5 - 22.5 cm^3 Accept ml

d_1 = 13.0 cm (1mk) 11.0 - 15.0 cm

(iii) (I) Determine the volume of the water displaced (1mk)

20 - 17 = 3 cm^3 Volume = $V_1 - V$

Follow SS working

Accept ml

(II) Determine the weight of the water displaced. (*density of water = 1g/cm³*) (2mks)

units conversion of volume to mass ie m=Vρ
must be shown
No ½mk
Convert mass to Newtons (kg to N)

d) (i) Use the Principle of moments to determine the apparent weight of the 20 g mass when fully immersed in water. (*g = 10N/kg*) (2mks)

Wkg Principle of moments substituted

Answer

4 s.f or exact. No units ½mk

(ii) Calculate the weight of the 20 g mass in air. (*g = 10N/kg*) (1mk)

$\frac{20}{1000} \times 10 = 0.2\,N$ No units ½mk

Ans from correct working

(iii) Determine the apparent loss in weight of the 20 g mass. (1mk)

Wt in air - wt in water . or wt of H_2O displaced.

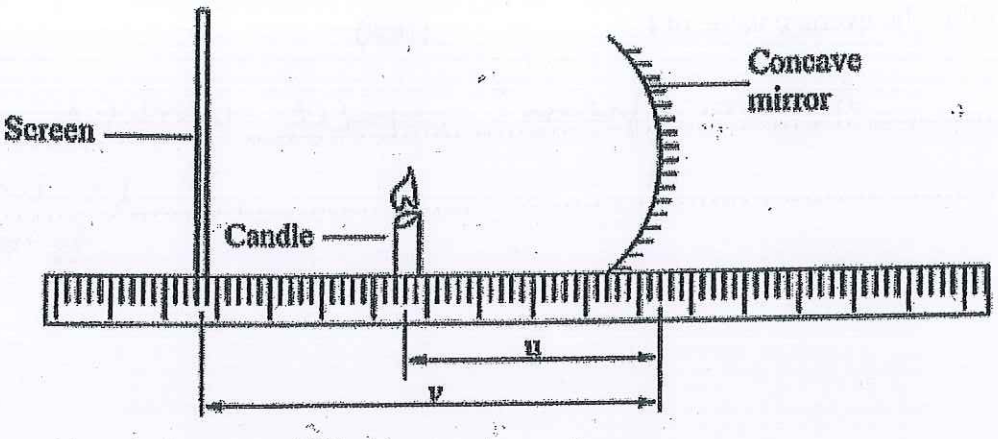
Ans from correct working

No units ½mk

Follow ss working all through

PART B

e) Light the candle and place it at distance u = 20 cm in front of the concave mirror. Adjust the position of the screen until a sharp image of the candle flame is obtained. See **Figure below.**



(i) Read and record the distance *v* between the screen and the mirror.

Follow ss

v = ... 18.0 - 22.0 cm ..... (1mk) ✓

(ii) Determine:

I. The magnification *m* of the mirror (1mk)

$m = v/u$ ..... Ans from correct working ✓ No units

.....

II. The value f_1 given that $f_1 = \frac{mu}{m+1}$ (2 mks)

Substitution ✓

Answer ✓ No units ½ mk

f) Repeat part e) for distance u_1 =18cm

(i) Read and record the distance v_1 between the screen and the mirror.

Follow ss

v_1 = ... 20.5 - 24.5 .....(1mk) ✓

(ii) determine the magnification m_1 of the mirror (1mk)

Answer from correct working ✓

(iii) Hence determine f_2 1mk

Answer from correct working No units ½ mk

g) Determine the average value of f. (1mk)

Answer from correct working

No units ½ mk