THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL

CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

031/2A **PHYSICS 2A**

ACTUAL PRACTICAL A

(For Both School and Private Candidates)

Time: 2:30 Hours **ANSWERS** **Year: 2022**

Instructions

1. This paper consists of two questions.

2. Answer all questions.

1. The aim of this experiment is to determine the density of a metre rule.

Proceed as follows:

(a) Locate the centre of gravity C of the metre rule AB by balancing freely at the knife edge.

The centre of gravity is found at the 50.0 cm mark on the metre rule.

(b) Suspend 100 g mass on the ruler with distance d = 10 cm from C, adjust the position of the knife edge to get a balance, as shown in the following figure.

(c) Record the distance y from the centre of gravity to a knife edge and distance x from knife edge to the known mass of 100 g.

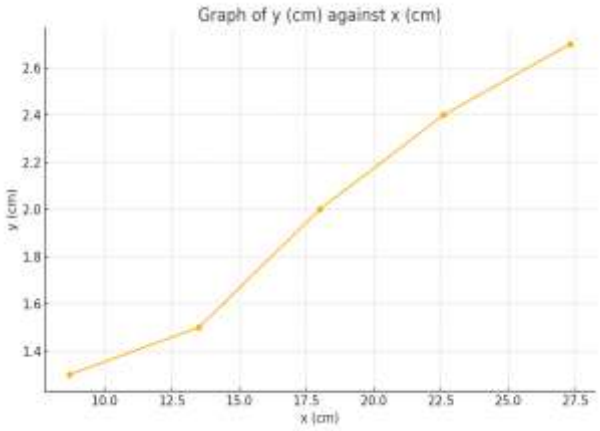
Recorded.

(d) Repeat the procedures in 1 (b) and (c) by increasing the distance of 100 g to d = 15 cm, 20 cm, 25 cm and 30 cm.

(i) Tabulate your results in a suitable table showing the values of d, x and y.

d (cm)	x (cm)	y (cm)
10	8.7	1.3
15	13.5	1.5
20	18.0	2.0
25	22.6	2.4
30	27.3	2.7

(ii) Plot a graph of y (cm) against x (cm).



(iii) Determine the slope of the graph.

Using the two points:
Point A: x = 13.5 cm, y = 1.5 cm
Point B: x = 27.3 cm, y = 2.7 cm
Slope = (2.7 − 1.5) / (27.3 − 13.5) = 1.2 / 13.8 ≈ 0.087

(iv) Describe how the slope obtained from the graph is related to the mass of the metre rule provided and hence determine the mass of a ruler.

Using the principle of moments:
Slope = 100 / M
M = 100 / slope = 100 / 0.087 ≈ 1149.43 g

The slope is the ratio of the known mass (100 g) to the mass of the metre rule.

(v) Measure and record the length, width and the thickness of the metre rule provided.

Length = 100.0 cm
Width = 2.5 cm
Thickness = 0.5 cm

(vi) Determine the density of a metre rule.

Volume = length × width × thickness
Volume = 100 × 2.5 × 0.5 = 125.0 cm^3
Mass = 1149.43 g
Density = mass / volume = 1149.43 / 125 = 9.20 g/cm^3

2. You are provided with a dry cell, resistance box, switch, an ammeter and a set of connecting wires.

Proceed as follows:

(a) Connect the given electrical components in series, switch must be open. Draw and label clearly your circuit.

The dry cell, resistance box, ammeter, switch, and connecting wires are connected in series. The circuit diagram is drawn with the resistor R, ammeter A in series, and the voltmeter connected across the terminals of the dry cell.

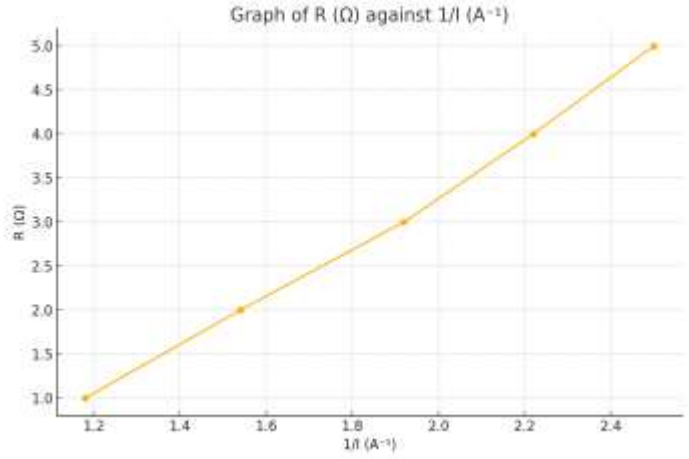
(b) Set resistance R = 1 Ω, then close the switch. Read and record the ammeter reading. Open the switch immediately after taking the readings.

(c) Repeat the procedures in 2 (b), setting the value of R = 2 Ω, 3 Ω, 4 Ω and 5 Ω.

(i) Tabulate your results including the values of 1/I

R (Ω)	I (A)	1/I (A^{-1})
1	0.85	1.18
2	0.65	1.54
3	0.52	1.92
4	0.45	2.22
5	0.40	2.50

(ii) Plot a graph of R against 1/I



(iii) From the graph, determine the slope and the vertical intercept.

Using points:
Point A: (1/I = 1.18, R = 1 Ω)
Point B: (1/I = 2.50, R = 5 Ω)
Slope = (5 − 1) / (2.50 − 1.18) = 4 / 1.32 ≈ 3.03 V

From the graph, vertical intercept is approximately 0.5 Ω

(iv) Use the results obtained in 2 (iii) to determine the internal resistance and e.m.f of a given dry cell.

Slope represents the e.m.f, E = 3.03 V
Intercept represents the internal resistance, r = 0.5 Ω

(v) What is the aim of doing this experiment?

The aim of this experiment is to determine the internal resistance and the e.m.f of a dry cell.