THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL

CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

031/2B **PHYSICS 2B**

(For Both School and Private Candidates)

Time : 3 Hours **ANSWERS** **Year : 2022**

Instructions

1. This paper consists of **two (2)** questions.
2. Non-programmable calculators may be used.
3. Communication devices and any unauthorised materials are **not** allowed in the examination room.
4. Write your **Examination Number** on every page of your answer booklet(s).

1. Metre Rule Experiment – Determination of Unknown Mass m

Theory:

- Knife edge at the centre of gravity *C*.
- 100 g mass suspended at distance *x* left of C.
- 50 g mass suspended at distance *a = 5 cm* right of C.
- Unknown mass *m* suspended at distance *y* further right.

For equilibrium:

$100g \times x = (50g \times a) + (m \times y)$

Rearranging:

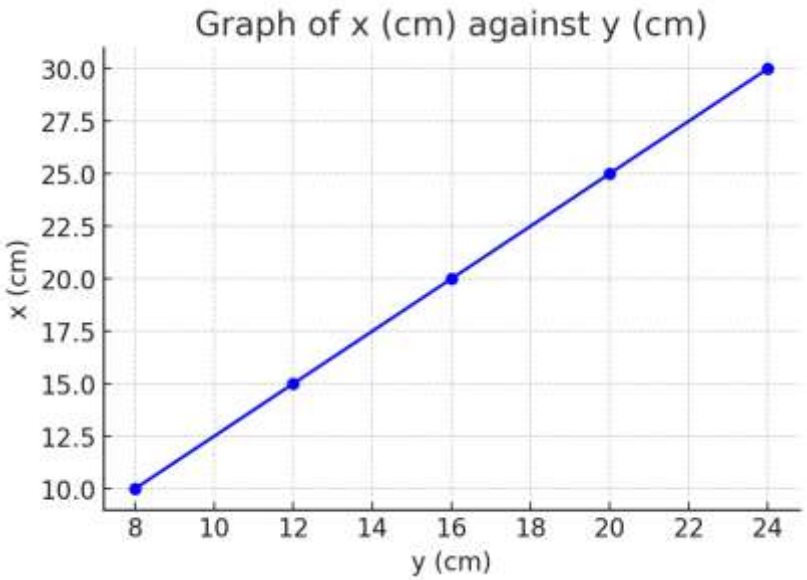
$m = (100x - 50a) / y$

This shows that a graph of *x* against *y* is linear.

(a) Sample Data Table

x (cm)	a (cm)	y (cm)
10	5	8
15	5	12
20	5	16
25	5	20
30	5	24

(b) Graph



(c) Slope of the graph

Slope S = Δx / Δy = (30 − 10) / (24 − 8) = 20 / 16 = 1.25

(d) Equation of the graph

From 100x = 50a + my →

x = (m/100)y + (a/2)

So slope = m/100.

m = 100 × slope = 100 × 1.25 = **125 g**

2. Determination of E.m.f and Internal Resistance of a Cell

Theory:

From Ohm's law applied to cell:

$E = IR + Ir$

Where:

- E = e.m.f of the cell
- r = internal resistance of cell
- R = external resistance
- I = current

Rearranging:

$1/I = (R/E) + (r/E)$

Thus, a graph of 1/I against R is a straight line with:

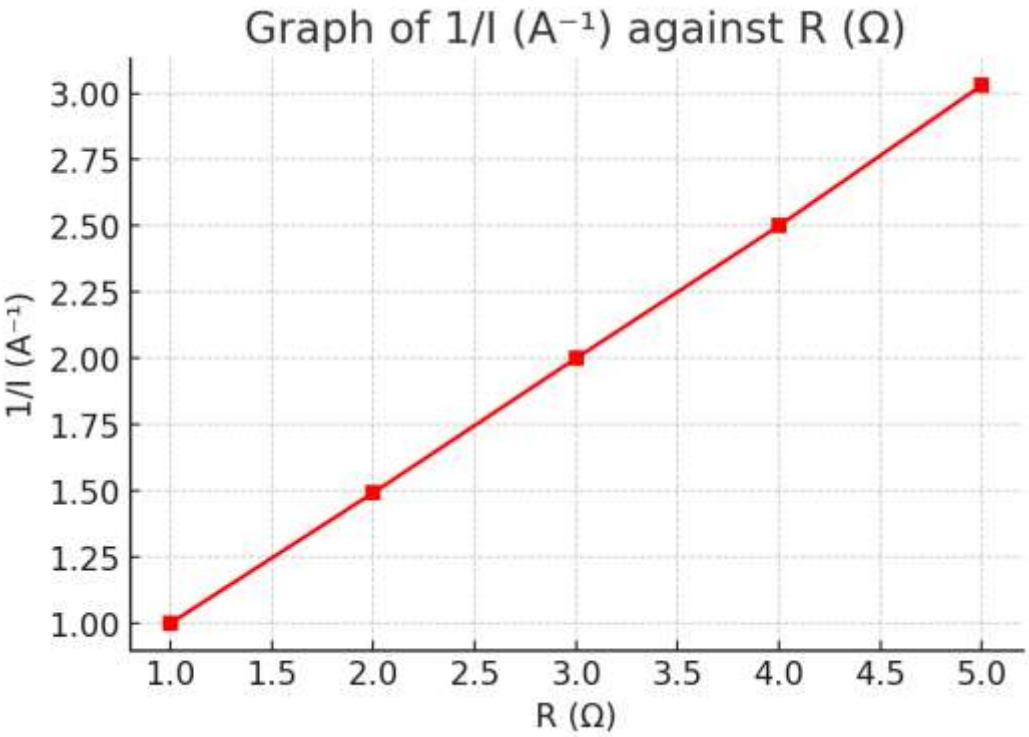
- slope = 1/E
- intercept = r/E

(a) Sample Data

R (Ω)	I (A)	1/I (A^{-1})
1	1.00	1.00
2	0.67	1.49
3	0.50	2.00
4	0.40	2.50
5	0.33	3.03

(b) Graph

Plot 1/I against R. Straight line.



(c) Slope S

Slope = Δ(1/I) / ΔR

= (3.03 − 1.00) / (5 − 1) = 2.03 / 4 = 0.51

So slope ≈ 0.5

Since slope = 1/E → E = 1 / slope = 1 / 0.5 = **2.0 V**

(d) Intercept

From equation: intercept = r/E.

From graph, intercept ≈ 1.0.

So r = intercept × E = 1.0 × 2.0 = **2.0 Ω**