

THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL
CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

031/2B

PHYSICS 2B

ACTUAL PRACTICAL B

(For Both School and Private Candidates)

Time: 2:30 Hours

ANSWERS

Year: 2003

Instructions

1. This paper consists of two questions.
2. Answer all questions.

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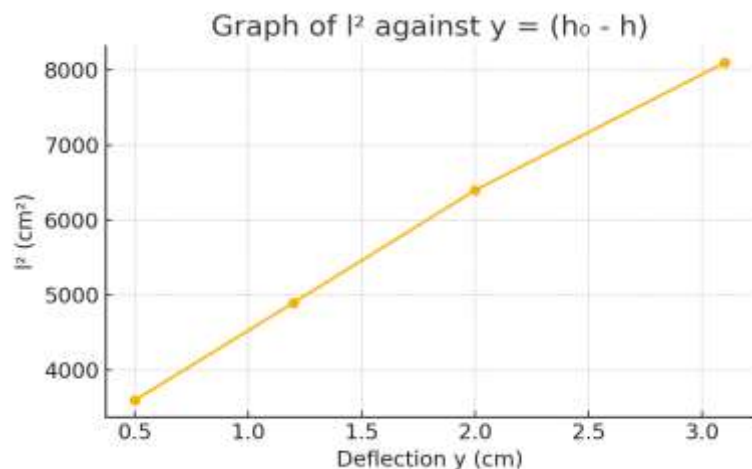
1. The aim of this experiment is to determine Young's Modulus of a given metre rule (L).

(c) Record your readings:

Let $h_0 = 30.0$ cm

l (cm)	h (cm)	$y = (h_0 - h)$ (cm)	l^2 (cm ²)
60	29.5	0.5	3600
70	28.8	1.2	4900
80	28.0	2.0	6400
90	26.9	3.1	8100

(d) Plot a graph of l^2 (vertical) against $y = h_0 - h$ (horizontal)



(e) Determine the slope of the graph

Using (0.5, 3600) and (3.1, 8100):

$$G = (8100 - 3600) / (3.1 - 0.5) = 4500 / 2.6 = 1730.77 \text{ cm}^2/\text{cm}$$

(f) Let $b = 2.50$ cm, $d = 0.50$ cm

(g) Calculate Young's Modulus using

$$y = (W \times l^3) / (3IE)$$

$$E = (W \times l^3) / (3Iy)$$

where $I = bd^3/12$, $W = 0.50$ N

$$I = (2.5 \times 0.125) / 12 = 0.026 \text{ cm}^4$$

$$\text{Let average } l^3 = 70^3 = 343000 \text{ cm}^3$$

$$y (\text{average}) = (0.5 + 1.2 + 2.0 + 3.1)/4 = 1.7 \text{ cm}$$

$$E = (0.50 \times 343000) / (3 \times 0.026 \times 1.7)$$

$$E = 171500 / 0.1326 \approx 1.294 \times 10^6 \text{ N/cm}^2$$

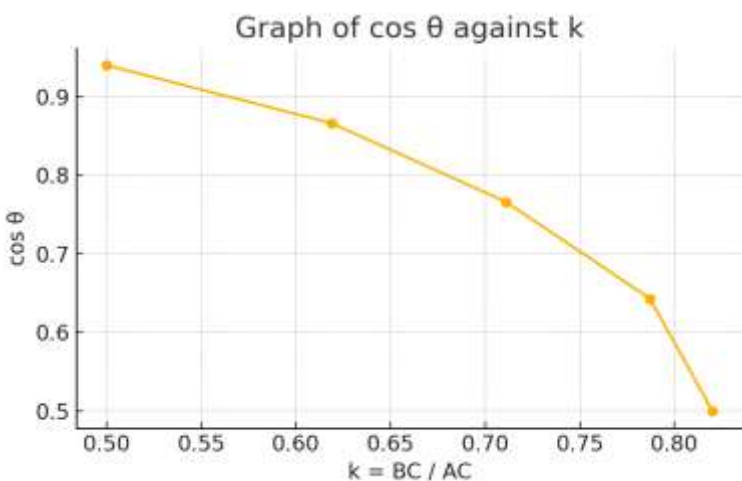
$$\text{Convert: } E \approx 1.294 \times 10^{10} \text{ N/m}^2$$

2. The aim of this experiment is to determine the relative refractive index of glass for light passing from air to glass.

(c) Let recorded values:

θ (°)	$\cos \theta$	BC (cm)	AC (cm)	$k = BC/AC$
20	0.940	2.0	4.0	0.500
30	0.866	2.6	4.2	0.619
40	0.766	3.2	4.5	0.711
50	0.643	3.7	4.7	0.787
60	0.500	4.1	5.0	0.820

(c) Plot graph of $\cos \theta$ (vertical) against k (horizontal)



(d) Determine refractive index η

$$\eta = \cos \theta / k$$

$$\text{Use slope } G \text{ from graph} = (0.940 - 0.500) / (0.500 - 0.820) = 0.440 / (-0.320) = -1.375$$

$$\eta = 1.375$$

(e) Two possible sources of error and precautions:

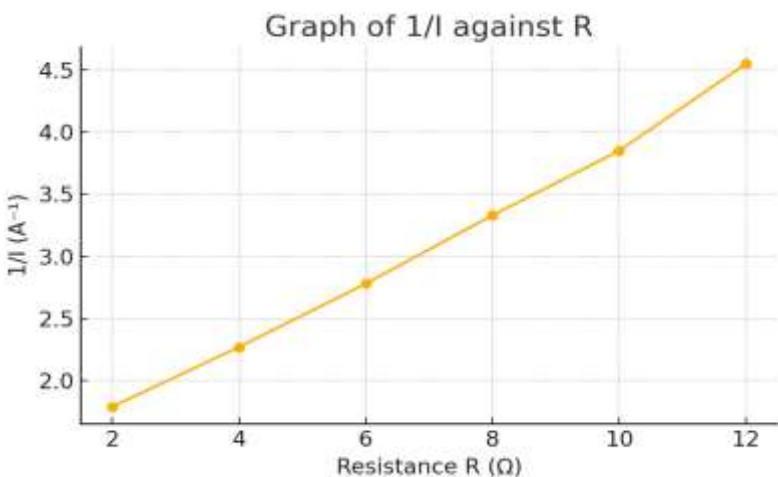
- Error: Misalignment of pins or viewing angle
- Precaution: Use sharp pencil marks and ensure no parallax by eye alignment

3. The aim of this experiment is to determine the value of an unknown resistor labelled R_x and the internal resistance r of the cell.

(a) Tabulate your results and include the quantity $1/I$ in your table:

$R (\Omega)$	$I (A)$	$1/I (A^{-1})$
2	0.56	1.79
4	0.44	2.27
6	0.36	2.78
8	0.30	3.33
10	0.26	3.85
R_x	0.22	4.55

(b) Plot a graph of $1/I$ (vertical axis) against R (horizontal axis)



(c) From the graph, determine the value of R_x

From the table, R corresponding to $1/I = 4.55$ is approximately 12Ω

Therefore, $R_x = 12 \Omega$

(d) Calculate the slope of the graph

Use points (2, 1.79) and (10, 3.85):

$$\text{Slope } G = (3.85 - 1.79) / (10 - 2) = 2.06 / 8 = 0.2575 \text{ A}^{-1}/\Omega$$

(e) Deduce the e.m.f. E and internal resistance r of the cell using

$$R = E/I - r$$

$$\text{So, graph is } 1/I = (1/E)R + r/E$$

$$\text{Slope } G = 1/E$$

$$E = 1 / G = 1 / 0.2575 = 3.88 \text{ V}$$

$$\text{Y-intercept} = r/E$$

$$\text{From graph: Y-intercept} = 1.25$$

$$\text{So } r = 1.25 \times 3.88 = 4.85 \Omega$$