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.

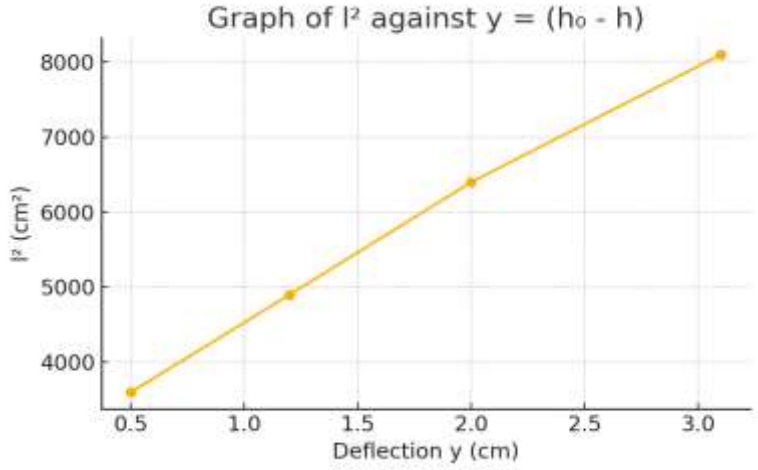
1. The aim of this experiment is to determine Young's Modulus of a given metre rule (L).

(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 cm^2/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

$I = (2.5 \times 0.125) / 12 = 0.026\ cm^4$
Let average $l^3 = 70^3 = 343000\ cm^3$
y (average) = (0.5 + 1.2 + 2.0 + 3.1)/4 = 1.7 cm

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

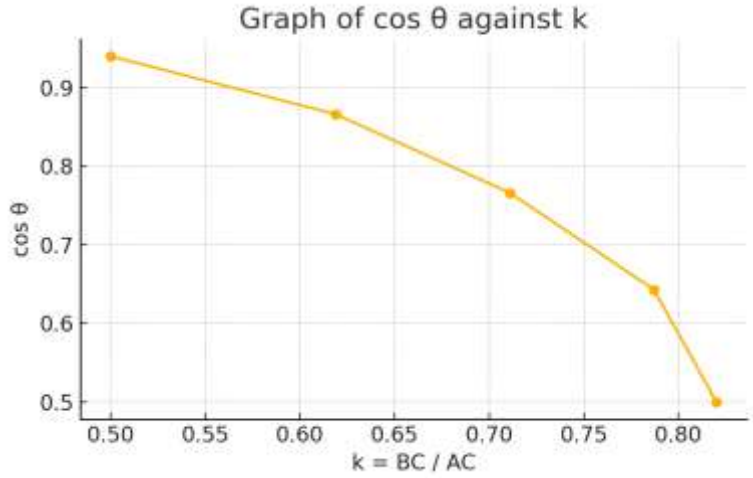
$E = 171500 / 0.1326 \approx 1.294 \times 10^6$ N/cm²
Convert: $E \approx 1.294 \times 10^{10}$ N/m²

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 θ	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 θ (vertical) against k (horizontal)



(d) Determine refractive index η
η = cos θ / k
Use slope G from graph = (0.940 - 0.500) / (0.500 - 0.820) = 0.440 / (-0.320) = -1.375
η = 1.375

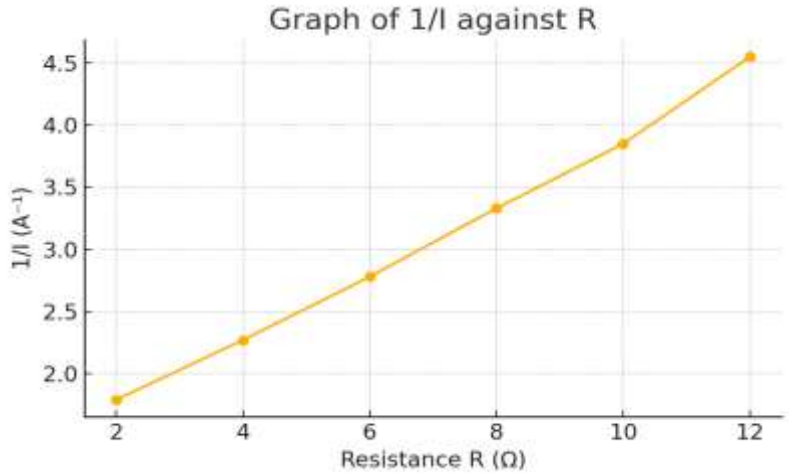
(e) Two possible sources of error and precautions:
- Error: Misalignment of pins or viewing angle
- Precaution: Use sharp pencil marks and ensure no parallax by eye alignment

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 (Ω)	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 12 Ω
Therefore, R_x = 12 Ω

(d) Calculate the slope of the graph
Use points (2, 1.79) and (10, 3.85):
Slope G = (3.85 - 1.79) / (10 - 2) = 2.06 / 8 = 0.2575 A^{-1}/Ω

(e) Deduce the e.m.f. E and internal resistance r of the cell using
R = E/I - r
So, graph is 1/I = (1/E)R + r/E

Slope G = 1/E
E = 1 / G = 1 / 0.2575 = 3.88 V

Y-intercept = r/E
From graph: Y-intercept = 1.25
So r = 1.25 × 3.88 = 4.85 Ω